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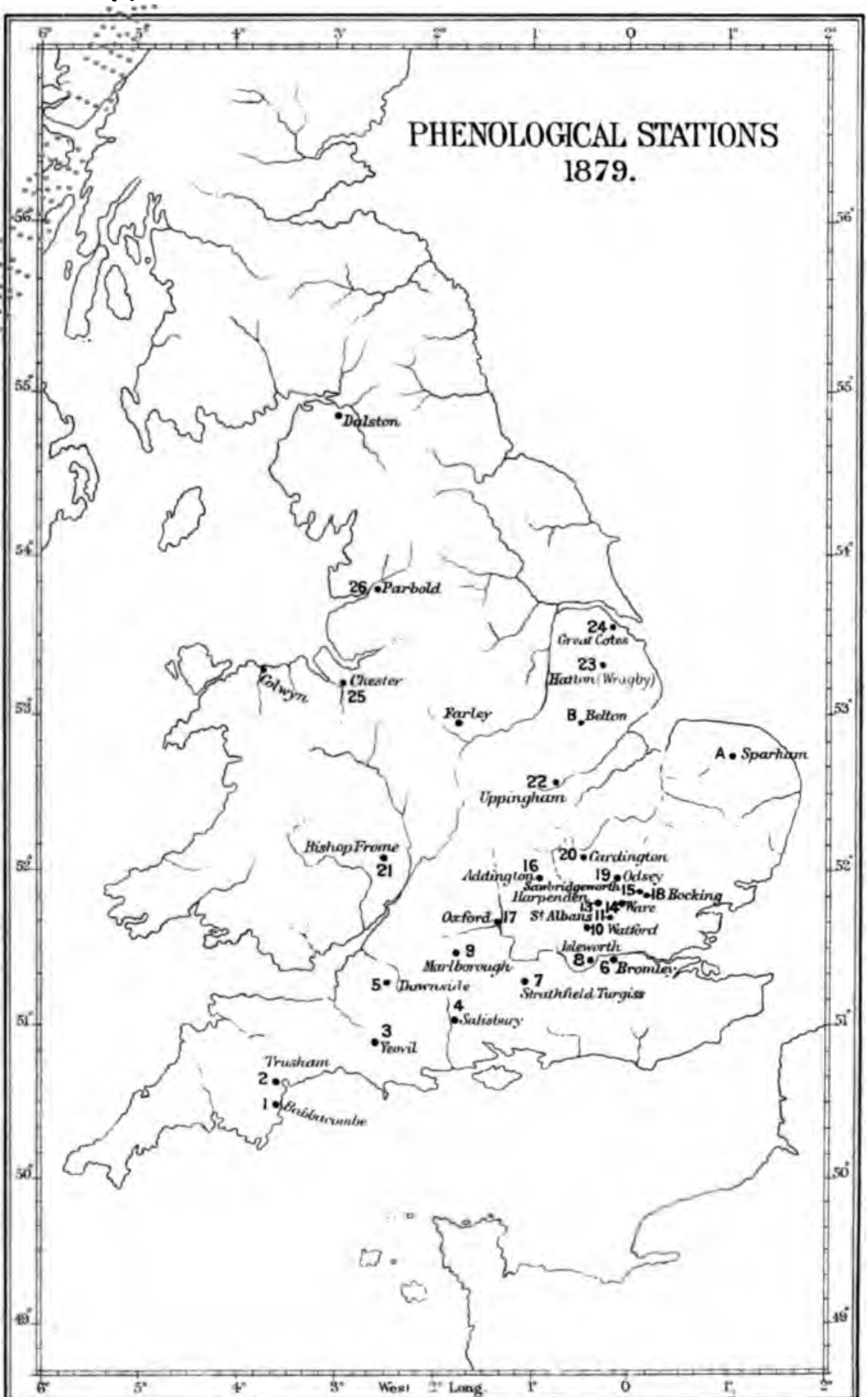

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VOL. VI. No. 33.

Report on the Phenological Observations for 1879. By the Rev. THOMAS ARTHUR PRESTON, M.A., F.M.S. (Plate I.)

[Read November 19th, 1879.]

THE reports have again been very satisfactory, and a larger number of specimens than usual has been sent in. It cannot be too strongly urged that the specimens are mainly wanted for comparison, though it must be admitted that they are often very useful for the purpose of verifying the species, 11 plants having been mistaken for others in the list in this year alone. The specimens need not be large, but sufficiently so to give a fair idea of the state of the plant at the time of gathering.

All last year's observers have sent in returns for the present year; besides several new ones :—

1. Babbacombe	Devon	E. E. Glyde, F.M.S.
2. Trusham	Devon	Rev. W. Moyle Rogers.
3. Yeovil	Somerset	Rev. J. Sowerby.
4. Salisbury	Wilts	W. Hussey.
5. Downside, Bath	Somerset	Rev. C. B. Kengelbacher, O.S.B.
6. Bromley	Kent	Rev. A. E. Eaton, M.A.
7. Strathfield Turgiss	Hants	Rev. C. H. Griffith, B.D., F.M.S.
8. Isleworth	Middlesex	Miss E. A. Ormerod, F.M.S.
9. Marlborough	Wilts	Rev. T. A. Preston, M.A., F.M.S.
10. Watford	Herts	J. Hopkinson, F.L.S., F.M.S.
11. St. Alban's	Herts	Mrs. Arnold.
12. Hertford	Herts	R. T. Andrews.
13. Harpenden	Herts	J. J. Willis.
14. Ware	Herts	Lieut. R. B. Croft, R.N., F.L.S.

15. Sawbridgeworth	Herts	Miss C. Donagan.
16. Addington	Bucks	J. Mathison.
17. Oxford	Oxfordshire	W. M. H. Milner.
18. Bocking	Essex	H. S. Tabor, F.M.S.
19. Odsey	Cambridgeshire	H. G. Fordham, F.G.S.
20. Cardington	Bedford	J. McLaren, F.M.S.
21. Bishop Frome	Hereford	Rev. H. L. Graham.
22. Uppingham	Rutland	W. H. Jones.
23. Hatton	Lincolnshire	Mrs. Jarvis.
24. Great Cotes	Lincolnshire	J. Cordeaux.
25. Chester	Cheshire	A. O. Walker, F.L.S., F.M.S.
26. Parbold	Lancashire	Mrs. Coombs.
A. Sparham	Norfolk	F. Norgate.
B. Belton, Grantham	Lincolnshire	Miss F. H. Woolward.
Farley, Cheadle	Staffordshire	C. L. Wragge, F.R.G.S., F.M.S.
Kimpton	Herts	Rev. T. D. Croft, M.A.
Hertford	Herts	H. C. Heard.
Dalston	Cumberland	Rev. E. Carr, M.A., F.M.S.

Some of the returns are very incomplete, and some only refer to Birds; but a beginning has been made, which, it is hoped, may be continued. Though all are valuable, the returns from Parbold and Dalston are especially so, as the stations are so far north, on the west side of England, where observers are particularly wanted.

1878. OCTOBER.—Generally a mild month: the unchecked vegetation continued, and an unusually large number of flowers was in bloom during the month: at Marlborough no less than 271 were found in flower. In addition to this several plants had a second blooming, the most remarkable being the Goldilocks (*R. auricomus*), Barren Strawberry (*P. fragariastrum*), Cow Chervil (*A. sylvestris*), Ground Ivy (*N. Glechoma*), and Dog's Mercury (*M. perennis*). Primroses were fairly abundant till the end of the year, in fact, more or less were found some time during each month. It was only towards the latter end of the month that plants began to "go off." At Isleworth, the Jerusalem Artichoke just came into flower on the 27th; it seldom flowers in England, except when the summer has been hot. The Red Dead Nettle (*L. purpureum*), generally so abundant at this time of year, was singularly scarce. On the 31st the leaves and flowers of French Beans and the leaves (not flowers) of the Dahlia were nipped by frost. As regards defoliation, the leafage on the 1st was altering to rich tints of a golden hue. Limes were almost leafless on the 12th, quite so by the 22nd; but few trees were leafless before the 24th, when some specimens of Birch and Beech were defoliated, Apple on the 26th, and Lombardy Poplar on the 30th.

NOVEMBER.—A cold, wet, cheerless month, with occasional snow; yet wild flowers still continued plentiful, 198 species being found near Marlborough and 116 at Isloworth. Defoliation progressed rapidly, most trees being bare

by the middle of the month, and all being leafless by the 30th, except Weeping Willows and many Oaks at Isleworth. At Salisbury the autumn tints were brightest about November 20th, and at Marlborough the Mulberry still had its leaves on November 18th.

DECEMBER.—A very cold month from the 8th to the 25th, when temperature rose; 41 plants were found in flower at Isleworth, 48 at Trusham, but only 35 at Marlborough, up to the 6th, when the commonest flowers were all cut down; even Daisies and Groundsel utterly vanished for a time. At Isleworth Ivy was still in flower on the 17th. At Hatton and elsewhere many birds died of cold during the month, and song birds were of course silent.

With the exception of a few days in the earlier parts of February and of March, the whole of the year 1879 has been characterised by a temperature almost invariably below the mean, accompanied with much wet and little or no sun; the effect on vegetation has been consequently very great. Foliage has, as a rule, been excessively luxuriant and dark, "forming the most remarkable feature of the year;" but rarely has fruit been able to ripen, and the second shoots have frequently been weak and unhealthy. Flowering has invariably been very late, as much as a month in some districts, the Hay harvest often not completed till nearly the end of August, some still in "Cock" in the Moorland district of Staffordshire as late as September 30th, and the corn harvest, not only extremely late, but the corn in very poor condition, and not properly ripened.

During JANUARY, owing to the severity of the frost, there was "nothing to record" in the botanical line. Everything was at a standstill, and rarely could even the very commonest plant be seen with an open flower. At Babbacombe, autumn sown wheat began to sprout, but made no progress up to the end of February. At Isleworth on the 15th "great quantities" of worms are reported to have been killed by the frost, in number sufficient to cause annoyance by their putrid smell. The Earth Thermometer at 1 foot deep had never recorded a temperature below 32°, though not higher than 33°, from December 29th, 1878. At Sparham on January 30th a walnut tree was split by the frost, and the sap frozen into yellow icicles, 2ft. 2½ins. long. A splitting of the tissues of rhubarb stalks was noticed at Isleworth in April 1878.

Average date of flowering at Marlborough 47 days later than in 1878.

FEBRUARY appears to have been every where "a cold, damp, miserable month," "all vegetation extremely backward," with "a remarkable dearth of even the commonest plants." At Isleworth careful observations were taken to determine the effect of cold on insect life, an opinion being generally prevalent that though vegetation might suffer from the cold, the destruction of insect life would more than counterbalance any damage done to the plants. This has been proved to be a fallacy. Larvæ and pupæ of insects of all orders were procured, and though apparently frozen and motionless at first, on being put into a warm room they gradually revived, and ultimately appeared to be quite uninjured, however great the cold to which they had been previously subjected. Only 5 species of plants came into flower at

Marlborough and Isleworth, "and those shortly after the warm period at the beginning of the month," as against 14 and 9 respectively in 1878.

Average date of flowering at Marlborough 31 days later than in 1878.

From the 4th to the 20th of MARCH temperature was above the mean, and vegetation progressed rather rapidly, but a period of severe cold again set in and everything was checked. But with all this the general reports at the end of the month were, "vegetation very backward," "vegetation extremely and abnormally backward." At Trusham on the 31st, "all wild flowers remained much as they were on the 13th; those that were open then becoming general only very gradually, and no fresh species flowering, but trees and shrubs were beginning to look green." At Salisbury on the 30th "country nearly colourless, (except green fields) as in the dead of winter." At Yeovil 23 species came into flower (24 in 1878), at Isleworth 14 (17 in 1878), and at Marlborough 20 as against 27 in 1878, but though the numbers which came into flower were not so very different in the two years, the number in flower was only about one half as many in 1879 as in 1878. Average date of flowering at Marlborough 39 days later than in 1878.

Though at Trusham there was "fairly typical APRIL weather," it appears not to have been generally the case in other parts of England. Snow fell frequently, and the days were sunless. Vegetation continued very backward, though "foliage progressed steadily, but not as fast or as luxuriantly as usual" (at Isleworth). At Yeovil 38 plants came into flower during the month (109 in 1878), whilst from January 1st the total number was only 82, as against 160 in 1878. At Isleworth 25 plants came into flower, as against 52 in 1878; at Marlborough 22 as against 70 in 1878; and by the end of the month there were 56 plants in flower in 1879, as against 132 in 1878. The average date of flowering at Marlborough, from 58 observations, was as much as 24 days later than in 1878. At Babbacombe the Horse Chestnut was in leaf on April 28th, whilst at Marlborough the buds were only opening on the 26th, and those of the Hawthorn on April 4th, hawthorn hedges being slightly tinted on the 28th. Hazel Catkins were plentiful in the early part of the month, but were almost entirely destroyed by the subsequent frosts. As instances of the slow progress of vegetation during the month, it may be mentioned that the Pyrus Japonica had fully formed and coloured flower buds on the 8th, but did not flower till the 27th, whilst the Ash had its stamens showing on the 5th, but flowers were not out properly till the 28th.

The same unsatisfactory state of weather continued through MAY, which may be characterised as a cold and generally sunless month.* At Babbacombe

* At Greenwich—

	Jan. hrs.	Feb. hrs.	Mar. hrs.	Apr. hrs.	May. hrs.	June. hrs.	July. hrs.	Aug. hrs.	Sept. hrs.
Total Amount of Sunshine due ..	259·1	277·9	367·4	414·9	482·1	494·5	496·8	449·1	376·9
Total Amount received	14·8	31·7	91·0	74·6	135·6	141·9	99·3	139·1	116·5
No. of absolutely Sunless Days ..	23	14	9	3	..	2	3	5	4
No. of Days with less than one hour's sunshine	3	5	4	7	5	3	6	4	6

"vegetation progressed rapidly after the middle of the month," and at other places the time between a plant coming into flower and being fairly in flower was shorter than in the earlier part of the year; but with all this it was a very unfavourable month, the number of hours of sunshine registered at Greenwich being only 135 (86 in 3 weeks). It has been generally noticed that the Oak and Ash came into leaf very nearly about the same time. At Yeovil plants were much behind 1878 and 1872, but were on the whole not very different in 1875, 1876 and 1877. The Laburnum and Lilac came into flower qûite towards the end of the month; the Hawthorn securing its title to "May" only in the south of England, whilst the Horse Chestnut was very variable, as early as the 9th at Torquay, and just open on the 31st at Marlborough.

June was a cold sunless month, the hours of sunshine at Greenwich in each week being only 26, 43, 23, and 27; "no summer weather, wet or windy," and vegetation still backward. Hay cutting did not begin till the 26th at Strathfield Turgiss, and later than this at more northerly stations. Foliage, however, was extremely dense, and the bloom of the flowering shrubs and trees, as Hawthorn, Laburnum, &c., was very luxuriant as long as it lasted. At Great Cotes, as elsewhere, "the crops suffered from wet, and slugs, grubs and insects of all kinds." No wall fruit ripened out of doors, and apples and pears either fell off the trees, or cracked from the wet.

July, especially during the latter half, was still more sunless; during the week ending the 23rd, only 7 hours of sunshine were registered at Greenwich: the month was "cold and wet," "very wet and no summer weather till the 23rd" at Trusham. Hay cutting did not begin till the 5th at Babbacombe. Potato disease and smut in wheat began to make their appearance, and the wheat itself did not come into flower till the 19th at Great Cotes. At Isleworth "the insect hum was fairly strong, but not so frequent as is usually the case in summer."

August was a little more sunny, and from the 9th to the 15th there was a week of seasonable weather; but the rest of the month was wet and very bad for agriculture, even at Babbacombe the Hay harvest was not finished till the 30th, while Barley was only cut on the 29th.

In September there were a few intervals of really fine weather, but as they were of no long duration, agricultural operations did not progress well. At Babbacombe wheat was cut on the 1st, and the harvest completed on the 20th, but that is an exception. Even as late as the 22nd hay was still out in some places; and in many localities the wheat harvest was not finished by the middle of October. The growth of weeds was very great, and occasionally the crops were almost overpowered by the Field Thistle (*C. arvensis*) or the Great Bindweed (*C. Sepium*). Foliage, though turning in a few instances, was very luxuriant and dark. Full particulars of the foliation at Isleworth are given (see page 17), where the observer has paid special attention to it, and compared it with that of previous years.

Taking a general view of Table I., it is certainly very remarkable how uniformly over England (except in a few special instances) plants have

TABLE I.

No	Plant.	1. Babbacombe.	2. Trusham.	3. Yeovil.	4. Salisbury.	5. Downside.	6. Bromley.	7. Strathfield T.	8. Isleworth.	9. Marlborough	10. Watford.	11. St. Albans.	12. Hertford.	13. Harpenden.	14. Ware.	15. Sawbridgeworth.	16. Addington.	17. Oxford.	18. Bocking.	19. Odsey.	20. Cardington.	21. Bishop Frome.	22. Uppingham	23. Hatton.	24. Gt. Cotes.	25. Chester, &c.	26. Parbold.	A. Sparham.	B. Belton.
1	ANEMONE NEMOROSA ..	..	91	78	77	n	84	95	91	78	93	95	83	100	87	..	107	109	..	..	93	93	98	112	97	..	117	88	98
2	RANUNCULUS FICARIA ..	87	65	63	66	n	75	72	88	60	75	76	79	97	74	..	72	74	..	..	94	65	88	97	77	..	112	n	..
3	*Ranunculus acris*	126	140	129	139	135	..	..	133	124	131	..	..	128	..	..	164	127	..	..	136	155	144	157	147	..	..	140	..
4	CALTHA PALUSTRIS	105	94	56	79	95	88	93	105	65	..	..	106	116	97		120	81	108	..	97	..	98	111	79	n	141	n	n
5	*Papaver Rhœas*	169	166	..	176	..	..	176	n	179	..	..	169	..	170	167	..	..	174	167	175	..	176	184	172	..	..	182	174
6	*Cardamine hirsuta*	87	3	48	68	..	93	..	80	80	..	..	83	111	..	..	..	109	..	..	93	..	..	128	..	..	..	114	..
7	*Cardamine pratensis*	126	112	109	..	114	118	123	108	116	124	129	120	124	116	..	125	118	132	..	124	125	123	131	130	..	136	140	..
8	*Draba verna*	..	66	18	64	n	86	98	74	115	..	..	96	n	..	..	87	63	..	..	64	..	63	111	103	n	..	n	..
9	*Viola odorata*	..	61	69	70	..	77	60	n	75	..	76	69	45	..	..	72	74	..	74	n	70	72	78	73	..	..	68	..
10	*Polygala vulgaris*	133	141	135	143	140	..	178	n	164	..	..	161	171	..	174	..	..	..	158	..	175	151	164	179	n	..	153	..
11	*Lychnis Flos-cuculi*	155	..	..	160	135	..	162	n	168	165	161	157	171	..	..	161	155	..	..	161	169	169	173	162	..	183	183	174
12	*Stellaria Holostea*	102	98	111	..	n	121	124	120	126	..	129	131	124	128	..	..	121	123	..	142	119	137	139	134	n	140	124	144
13	MALVA SYLVESTRIS	169	167	..	175	..	..	190	n	175	182	..	178	..	184	178	n	..	207	..	176	..	180	n	179	..	..	183	193
14	*Hypericum tetrapterum* ..	..	213	..	176	..	..	..	225	214	..	..	..	..	..	..	..	..	197	..	..	..	219	..	214	..	..	..	190
15	*Hypericum pulchrum* ..	212	194	..	176	..	..	..	..	214	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	GERANIUM ROBERTIANUM	116	108	135	146	133	..	139	141	145	140	148	152	150	..	148	150	140	142	156	150	..	149	157	151	n	164	n	168
17	TRIFOLIUM REPENS	148	..	..	153	..	..	154	157	167	152	152	157	159	163	170	161	143	168	..	163	..	161	160	175	..	174	..	169
18	*Lotus corniculatus*	145	141	..	155	..	..	..	156	155	158	157	167	160	179	162	164	156	168	..	161	169	161	171	166	n	166	..	170
19	*Vicia Cracca*	218	..	..	181	..	..	..	205	198	193	..	189	193	..	..	..	..	181	..	189	196	201	185	176	..	197	183	..
20	*Vicia sepium*	133	118	135	135	..	..	..	149	140	143	132	151	149	..	..	..	143	142	..	158	..	136	..	..	..	164	..	n
21	*Lathyrus pratensis*	191	155	..	163	..	..	..	179	166	182	..	167	182	168	173	..	..	168	..	171	169	179	178	167	..	..	182	..
22	PRUNUS SPINOSA	114	94	114	91	..	..	118	115	125	123	122	120	121	118	..	125	120	122	117	118	124	121	129	131	n	..	122	..
23	*Spiræa Ulmaria*	196	189	..	180	..	..	188	196	182	193	..	193	202	..	179	188	..	186	..	186	189	192	195	189	..	202	..	190
24	*Potentilla anserina*	151	149	..	146	140	..	150	145	149	154	153	163	152	148	162	168	140	172	150	152	..	144	160	166	n	..	..	167
25	*Potentilla Fragariastrum*	67	20	43	56	..	..	79	101	66	75	..	71	101	128	..	..	..	109	..	98	n	101	112	..	..	..	104	..
26	*Rosa canina*	173	167	..	171	..	..	173	180	182	171	..	172	179	177	178	185	..	171	175	177	180	177	182	187	..	189	181	180
27	*Epilobium hirsutum*	256	218	..	209	..	..	..	210	214	..	..	..	218	..	..	..	..	208	..	214	214	211	..	216	..	..	..	..
28	*Epilobium montanum* ..	..	..	..	175	..	..	..	171	178	180	..	169	178	..	..	..	..	173	..	177	..	181	..	..	..	197	186	178
29	*Angelica sylvestris*	..	220	..	210	..	..	..	212	214	..	..	..	..	..	..	..	..	240	..	216	..	..	..	..	..	..	..	..
30	*Anthriscus sylvestris* ..	..	..	114	135	..	128	..	132	125	124	129	137	121	128	..	126	112	..	131	114	..	..	140	141	..	..	118	..
31	HEDERA HELIX	..	..	273	260	..	..	..	272	290	273	..	..	..	..	..	..	282	275	276	258	..	..	..	..	..	..	280	..
32	*Galium Aparine*	149	118	..	155	..	..	156	149	149	145	153	157	164	158	..	..	148	n	..	148	..	165	176	168	..	..	159	164
33	*Galium verum*	198	195	..	188	..	..	..	197	195	199	..	205	196	..	..	192	..	..	..	196	202	198	200	196	..	..	..	192
34	*Dipsacus sylvestris*	..	n	..	221	..	..	..	241	221	..	..	..	..	..	..	..	..	242	..	218	..	..	..	226	..	..	..	..
35	*Scabiosa succisa*	237	209	..	223	..	..	..	242	214	..	..	..	..	..	..	..	..	..	..	..	234	..	193	232	..	..	..	n
36	*Petasites vulgaris*	..	..	78	..	..	..	94	n	46	..	97	83	..	..	..	n	120	..	..	..	..	88	..	95	..	..	..	..

TABLE I.—

No.	Plant.	1. Babbacombe.	2. Trusham.	3. Yeovil.	4. Salisbury.	5. Downside.	6. Bromley.	7. Strathfield T.	8. Isleworth.	9. Marlborough	10. Watford.	11. St. Albans.	12. Hertford.	13. Harpenden.	14. Ware.	15. Sawbridge-north.	16. Addington.	17. Oxford.	18. Bocking.	19. Odsey.	20. Cardington.	21. Bishop Frome.	22. Uppingham	23. Hatton.	24. Gt. Cotes.	25. Chester, &c.	26. Parbold.	A. Sparham.	B. Belton.
37	TUSSILAGO FARFARA	106	60	63	65	..	..	69	68	61	n	..	73	91	60	..	n	48	..	62	65	66	70	99	78	n	67	78	..
38	ACHILLEA MILLEFOLIUM	187	182	..	175	..	..	176	170	176	193	..	..	195	..	..	164	..	190	..	187	..	179	190	196	..	197	181	190
39	*Chrysanthemum Leucanth.*	146	139	140	153	..	..	150	n	159	156	..	163	164	..	163	..	143	168	..	150	161	161	164	173	..	175	..	171
40	*Artemisia vulgaris*......	..	216	..	221	..	..	..	222	222	..	..	..	..	..	..	n	..	..	..	..	..	..	..	233	..	..	..	..
41	*Senecio Jacobæa*	210	196	..	191	..	..	..	179	194	199	..	193	216	..	..	..	..	..	..	197	198	200	208	212	..	196	187	190
42	CENTAUREA NIGRA......	220	..	..	n	..	..	182	179	204	..	..	191	190	..	..	..	..	203	..	185	n	..	193	195	..	..	..	191
43	*Carduus lanceolatus*	208	207	..	204	..	..	..	204	204	..	..	205	181	..	..	..	..	242	..	213	..	..	..	205	..	..	..	..
44	*Carduus arvensis*	207	196	..	199	..	..	..	203	203	..	168	191	203	..	..	..	..	..	..	198	..	..	206	205	..	..	..	..
45	*Sonchus arvensis*	..	n	..	n	..	..	..	211	214	214	..	205	211	..	..	..	..	251	..	215	..	232	..	200	..	..	..	..
46	*Hieracium Pilosella*	154	141	..	146	..	..	..	169	159	..	..	163	160	..	..	..	158	180	..	151	170	162	n	..	..	..	159	n
47	CAMPANULA ROTUNDIF...	..	..	..	188	..	..	..	203	202	..	..	..	203	..	..	..	..	210	.	..	213	196	208	200	..	..	187	191
48	*Gentiana campestris*	..	..	..	..	..	..	..	..	n	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
49	CONVOLVULUS SEPIUM ..	231	223	..	210	..	..	194	197	222	..	..	..	..	..	..	..	..	226	..	213	..	236	..	235	..	..	..	..
50	*Symphytum officinale* ..	..	..	136	135	..	..	..	156	133	131		..	..	..	..	..	132	..	..	..	..	150	..	..	..	..	..	..
51	*Pedicularis sylvatica*....	..	114	128	..	140	..	..	160	144	148	..	163	..	..	..	..	..	..	..	..	163	..	144	..	n	177	153	..
52	*Veronica Chamædrys* ..	120	109	114	..	..	137	63	132	129	138	..	..	146	..	..	140	132	139	130	133	..	133	144	142	n	164	..	151
53	*Veronica hederifolia*....	..	37	63	65	111	..	..	97	66	..	..	77	88	..	..	..	63	..	70	66	..	36	..	..	..	..	106	..
54	*Mentha aquatica*........	..	224	..	n	..	..	..	227	n	..	..	..	..	..	..	..	..	241	..	218	..	220	..	..	..	..	..	..
55	*Thymus Serpyllum*	167	..	..	176	..	..	..	..	167	..	..	..	194	..	..	..	..	..	166	..	191	219	..	..	..	..	197	181
56	*Prunella vulgaris*	185	..	..	n	..	..	162	180	172	..	..	190	189	..	..	171	..	183	..	171	176	184	180	..	..	199	157	n
57	*Nepeta Glechoma*	97	67	87	91	98	..	96	101	98	109	..	97	108	107	..	118	111	109	108	108	..	107	122	114	n	..	106	..
58	*Galeopsis Tetrahit*	..	191	..	n	..	..	176	211	191	..	..	183	202	..	..	..	..	..	..	212	..	193	..	..	..	..	..	..
59	*Stachys sylvatica*	..	..	..	171	..	..	..	179	179	173	..	..	181	170	..	..	..	178	..	177	181	181	178	..	..	197	178	..
60	*Ajuga reptans*	142	n	126	..	..	138	..	139	138	143	151	152	137	..	162	140	132	..	..	140	..	137	141	147	n	135	..	151
61	PRIMULA VERIS	98	..	98	..	..	..	..	114	116	103	94	106	77	107	..	109	..	107	107	104	114	114	122	118	n	..	n	..
62	*Plantago lanceolata*	124	118	118	..	..	123	127	132	125	138	139	139	138	144	..	142	125	133	..	124	..	138	144	149	..	..	181	..
63	*Mercurialis perennis*	98	61	67	65	n	..	70	79	69	89	132	83	92	87	..	n	55	106	..	106	95	95	..	..	..	..	93	..
64	*Ulmus montana*	87	64	72	..	133	..	..	79	79	..	..	72	90	..	..	n	60	..	91	89	..	..	..	..	..	..	n	..
65	*Salix caprea*	87	..	69	78	..	77	..	80	76	75	80	77	75	74	..	..	76	..	79	91	78	90	94	101	n	..	87	..
66	*Corylus Avellana*	67	29	31	17	..	..	37	43	41	46	..	43	43	51	..	51	40	..	47	42	50	47	58	n	n	..	61	..
67	*Orchis maculata*........	175	n	..	163	128	..	..	..	167	167	..	..	173	..	168	..	..	..	..	164	156	176	164	172	n	..	..	178
68	*Iris Pseud-acorus*	175	n	..	160	..	..	177	177	167	170	172	169	..	165	174	..	..	171	..	171	..	n	..	169	n	190	..	175
69	*Narcissus Pseudo-narcis.*	..	67	77	70	n	..	81	80	75	89	..	82	89	..	..	93	78	..	90	97	..	..	..	100	.	84	89	..
70	*Galanthus nivalis*	..	46	43	35	..	..	36	46	40	37	..	..	41	43	..	42	72	..	38	36	..	44	n	52	n	..	40	37
71	*Endymion nutans*	125	n	119	135	..	130	123	132	125	138	129	137	139	144		142	125	..	..	132	..	128	139	142	n	..	145	143

TABLE II.

No. and Name of Plant.	Years.	3. Yeovil.	4. Salisbury.	7. Strathfield Turgiss.	8. Isleworth.	9. Marlborough.	10. Watford.	14. Ware.	20. Cardington.	21. Bishop Frome.	24. Great Cotes.
70. *Galanthus nivalis* (Snowdrop)	1875	26	..	2	..	15	..	..	..	..	..
	1876	50	..	31	30	30	..	..	28	..	32
	1877	23	16	18	19	21	..	..	11	..	20
	1878	26	17	32	44	29	..	23	20	n	31
	1879	43	35	36	46	40	37	43	36	..	52
66. *Corylus Avellana* (Hazel)	1875	16	..	5	..	18	..	..	..	..	..
	1876	28	..	6	..	23	..	..	29	36	..
	1877	9	2	9	28	15	..	..	15	9	..
	1878	27	21	43	23	39	47	25	41	50	..
	1879	31	17	37	43	41	46	51	42	50	n
2. RANUNCULUS FICARIA (Pilewort)..	1875	16	..	40	95	32	..	..	95	..	89
	1876	50	..	39	62	46	85	81	50	52	73
	1877	9	20	..	50	19	..	38	39	43	67
	1878	15	21	50	49	18	59	52	42	32	n
	1879	63	66	72	88	60	75	74	94	65	77
63. *Mercurialis perennis* (Dog's Mercury)	1875	30	..	..	..	64	..	..	..	..	..
	1876	53	..	74	..	60	85	..	55	59	98
	1877	37	15	40	..	25	..	38	36	34	..
	1878	49	31	..	69	31	47	51	43	50	75
	1879	67	65	70	79	69	89	87	106	95	..
37. TUSSILAGO FARFARA (Coltsfoot) ..	1875	74	..	..	..	69	..	..	..	..	74
	1876	53	..	52	67	60	70	..	57	53	73
	1877	45	80	125	52	45	..	38	42	64	45
	1878	49	61	65	55	48	..	52	47	48	49
	1879	63	65	69	68	61	n	60	65	66	78
25. *Potentilla Fragariastrum* (Barren Strawberry)	1875	..	..	27	..	64	..	..	..	..	..
	1876	36	..	54	..	59	75	79	69	..	..
	1877	all yr.	46	19	81	42	..	..	50	35	98
	1878	all yr.	n	45	80	21	65	74	54	51	76
	1879	43	56	79	101	66	75	128	98	n	..
9. *Viola odorata* (Sweet Violet) ..	1875	28	..	23	..	72	..	..	..	..	68
	1876	39	..	8	36	62	71	..	62	60	64
	1877	41	45	4	75	56	..	..	49	50	48
	1878	51	61	56	70	61	63	..	57	28	n
	1879	69	70	60	n	75	..	..	n	70	73
65. *Salix caprea* (Great Sallow) ..	1875	69	..	65	..	73	..	..	91	..	..
	1876	63	..	..	..	61	..	..	83	..	71
	1877	47	n	..	..	48	..	..	50	n	86
	1878	63	59	..	..	67	63	63	62	61	70
	1879	69	78	..	80	76	75	74	91	78	101
69. *Narcissus Pseudo-narcissus* (Daffodil)	1875	93	..	..	..	82	..	..	..	..	..
	1876	70	..	67	74	60	..	..	75	78	..
	1877	65	..	55	65	45	.	72	74	..	..
	1878	64	..	60	60	48	68	60	72	68	..
	1879	77	70	81	80	75	89	..	97	..	100
64. *Ulmus montana* (Wych Elm)	1875	69	..	..	..	68	..	..	..	..	..
	1876	59	..	..	71	59	..	..	67	..	..
	1877	45	..	120	54	58	..	..	56	..	..
	1878	56	..	..	58	57	..	..	67	88	..
	1879	72	..	..	79	79	..	..	89	..	..
8. *Draba verna* (Whitlow Grass)	1875	..	..	..	..	73	..	..	95	..	..
	1876	..	..	..	68	58	..	..	53	..	..
	1877	all yr.	35	..	39	49	..	..	27	..	..
	1878	all yr.	24	..	61	48	..	..	48	..	..
	1879	18	64	98	74	115	..	..	64	..	103
1. ANEMONE NEMOROSA (Wood Anemone)	1875	92	..	80	..	76	..	..	94	..	94
	1876	77	..	84	91	62	81	83	88	68	92
	1877	62	72	74	85	73	..	83	86	76	91
	1878	63	60	70	77	55	..	67	72	61	..
	1879	78	77	95	91	78	93	87	93	93	97

TABLE II.—*Continued.*

d Name Plant.	Year.	3. Yeovil.	4. Salisbury.	7. Strathfield Turgiss.	8. Isleworth.	9. Marlborough.	10. Watford.	14. Ware.	20. Cardington.	21. Bishop Frome.	24. Great Cotes.
	1875	76	..	..	..	86	..	..	115	..	102
A PALUS-	1876	40	..	74	90	59	..	91	94	..	67
arsh Mari-	1877	40	55	47	90	45	..	89	49	67	89
....	1878	47	n	70	66	50	..	80	60	71	55
	1879	56	79	93	105	65	..	97	97	..	79
	1875	88	..	..	..	92	..	..	117	..	104
Glechoma	1876	76	..	90	98	92	97	90	95	95	103
Ivy) ...	1877	69	75	..	101	102	..	..	93	98	102
	1878	73	63	..	88	66	81	78	76	78	68
	1879	87	91	96	101	98	109	107	108	..	114
	1875	90	..	89	106	102	..	..	106	..	..
S SPINOSA	1876	95	..	95	95	97	97	97	94	102	99
orn)	1877	65	36	..	62	83	..	55	48	92	92
	1878	72	70	77	90	72	..	75	76	95	90
	1879	114	91	118	115	125	123	118	118	124	131
	1875	92	..	91	..	109	..	..	100	..	102
LA VERIS	1876	85	..	94	115	107	78	89	97	91	96
)	1877	90	88	..	107	97	..	73	94	62	87
	1878	81	96	68	97	102	80	78	86	71	83
	1879	98	..	..	114	116	103	107	104	114	118
	1875	33	..	..	97	88	..	..	125	..	..
ecus sylves-	1876	77	..	..	108	117	..	111	118	..	..
w Chervil)	1877	40	96	114	99	91	119	105	104	112	..
	1878	74	63	..	109	18	97	..	60	104	115
	1879	114	135	..	132	125	124	128	114	..	141
	1875	91	..	104	..	116	..	..	115	..	114
nine pra-	1876	99	..	106	115	96	111	106	112	111	109
(Cuckoo-	1877	73	92	103	90	91	..	103	104	108	102
....	1878	77	67	86	96	76	97	98	96	102	89
	1879	109	..	123	108	116	124	116	124	125	130
	1875	..	..	105	..	109	..	..	127	103	..
a Holostea	1876	95	..	102	91	107	111	95	118	..	113
: Stitch-	1877	45	82	79	86	85	98	88	113	73	98
....	1878	82	85	102	94	95	83	100	105	105	105
	1879	111	..	124	120	126	..	128	142	119	134
	1875	113	..	114	..	98	..	..	..	..	114
mion nu-	1876	119	..	111	111	107	114	..	116	118	113
ae-bell) ..	1877	99	99	108	107	100	112	..	113	120	123
	1878	101	99	98	104	102	112	112	..	109	114
	1879	119	135	123	132	125	138	144	132	..	142
	1875	89	..	...	..	109	..	..	129	..	..
ca Chamæ-	1876	94	..	..	107	124	125	123	123	123	..
ermander-	1877	76	97	78	111	114	112	..	121	122	..
ll)	1878	74	65	47	102	90	114	115	106	115	n
	1879	114	..	63	132	129	138	..	133	..	142
	1875	109	..	..	..	116	..	..	123	..	..
go lanceo-	1876	99	..	..	115	117	..	105	112	..	..
wort Plan-	1877	99	..	..	120	114	..	114	111	..	..
....	1878	99	..	105	114	103	114	..	108	127	134
	1879	118	..	127	132	125	138	144	124	..	149
	1875	119	..	..	..	90	..	..	131	..	137
culus acris	1876	120	..	..	115	105	..	119	116	..	..
Crowfoot)	1877	120	111	..	116	114	..	..	47	137	137
	1878	109	105	108	112	79	..	..	47	118	121
	1879	129	139	..	133	124	131	..	136	155	147
	1875	115	..	123	137	130	..	..	128	..	..
a reptans	1876	120	..	..	126	107	133	128	125	125	..
....	1877	103	n	..	133	128	131	123	132	124	144
	1878	108	110	..	122	117	118	120	121	n	136
	1879	126	..	..	139	138	143	..	140	..	147

TABLE II.—*Continued.*

No. and Name of Plant.	Years.	3. Yeovil.	4. Salisbury.	7. Strathfield Turgiss.	8. Isleworth.	9. Marlborough.	10. Watford.	14. Ware.	20. Cardington.	21. Bishop Frome.	24. Great Cotes.
16. GERANIUM ROBERTIANUM (Herb Robert) ……	1875	113	..	124	..	116	..	..	140	..	133
	1876	120	..	114	131	125	121	128	124	133	133
	1877	131	120	42	141	139	140	109	144	140	151
	1878	112	112	111	132	116	118	121	126	127	124
	1879	135	146	139	141	145	140	..	150	..	151
32. *Galium Aparine* (Cleavers) ……	1875	..	..	..	..	123	..	..	133	..	..
	1876	127	168	..	146	139	146	152	137	..	155
	1877	132	151	n	145	135	147	147	144	..	156
	1878	123	142	128	132	124	132	137	126	..	162
	1879	..	155	156	149	149	145	158	148	..	168
17. TRIFOLIUM REPENS (Dutch Clover) …………	1875	..	..	122	..	135	..	..	160	..	..
	1876	..	..	135	152	149	..	150	152	146	157
	1877	138	163	..	161	153	153	..	159	149	..
	1878	120	143	126	134	134	129	144	138	..	161
	1879	..	153	154	157	167	152	163	163	..	175
24. *Potentilla anserina* (Silver-weed)	1875	..	..	..	..	133	..	..	158	..	..
	1876	132	..	143	142	139	..	143	145	162	152
	1877	141	147	..	163	146	158	..	145	172	153
	1878	116	127	..	137	129	138	136	134	..	138
	1879	..	146	150	145	149	154	148	152	..	166
18. *Lotus corniculatus* (Bird's-foot)..	1875	..	..	137	..	136	..	..	157	..	..
	1876	134	154	150	162	148	153	146	151	155	..
	1877	145	158	..	156	156	162	..	158	159	163
	1878	134	134	..	139	132	135	151	138	..	141
	1879	..	155	..	156	155	158	179	161	169	166
39. *Chrysanthemum Leucanthemum* (Ox-eye) ……	1875	..	..	134	..	136	..	..	140	..	..
	1876	..	..	133	141	148	149	152	136	148	..
	1877	139	152	132	152	158	151	..	134	157	..
	1878	109	124	121	127	136	135	140	121	n	162
	1879	140	153	150	n	159	156	..	150	161	173
46. *Hieracium Pilosella* (Mouse-ear Hawkweed)……	1875	..	..	..	..	134	..	..	148	..	..
	1876	..	144	..	144	146	..	142	139	142	..
	1877	138	144	..	150	135	154	..	148	..	..
	1878	123	124	..	134	132	141	..	130	..	..
	1879	..	146	..	169	159	..	..	151	170	..
11. *Lychnis Flos-cuculi* (Ragged Robin) ……	1875	..	..	..	..	140	..	..	143	..	129
	1876	..	156	153	154	158	154	145	152	159	150
	1877	150	155	145	153	161	162	..	159	160	156
	1878	137	134	134	137	134	148	..	139	145	143
	1879	..	160	162	n	168	165	..	161	169	162
21. *Lathyrus pratensis* (Meadow Vetchling)…………	1875	..	..	..	..	147	..	..	..	..	161
	1876	..	174	158	162	162	..	164	165	..	..
	1877	..	167	..	166	167	164	..	165	..	172
	1878	156	155	..	160	157	150	..	161	..	161
	1879	..	163	..	179	166	182	168	171	169	167
5. *Papaver Rhœas* (Red Poppy) ….	1875	..	..	..	..	141	..	..	144	..	..
	1876	..	..	163	163	165	154	160	159	..	..
	1877	..	151	..	157	166	160	..	164	..	..
	1878	134	156	172	146	157	146	151	155	..	161
	1879	..	176	176	n	179	..	170	175	..	172
68. *Iris Pseud-acorus* (Yellow Iris)….	1875	..	..	154	159	150	..	..	..	..	162
	1876	..	153	171	164	156	162	160	167	167	169
	1877	..	..	..	165	165	163	..	172	..	166
	1878	..	138	152	152	141	145	145	153	..	153
	1879	..	160	177	177	167	170	165	171	..	169
26. *Rosa canina* (Dog Rose) ………	1875	..	..	..	160	150	..	..	160	..	157
	1876	..	160	164	165	165	163	164	161	165	167
	1877	..	165	160	166	164	164	..	165	166	172
	18;8	154	154	133	151	151	146	150	158	150	154
	1879	..	171	173	180	182	171	177	177	180	187

TABLE II.—*Continued.*

nd Name Plant.	Years.	3. Yeovil.	4. Salisbury.	7. Strathfield Turgiss.	8. Isleworth.	9. Marlborough.	10. Watford.	14. Ware.	20. Cardington.	21. Bishop Frome.	24. Great Cotes.
A SYLVES- (Common-)	1875	..	..	164	..	156	..	..	156	..	154
	1876	..	..	164	163	171	162	161	170	186	169
	1877	..	166	172	163	165	168	..	167	179	172
	1878	157	156	175	153	161	150	154	163	..	161
	1879	..	175	190	n	175	182	184	176	..	179
ys sylvatica Wound-	1875	..	..	169	..	160	..	..	164	..	..
	1876	..	n	168	176	171	170	161	166	176	..
	1877	..	169	..	168	173	..	..	169	172	..
	1878	154	153	..	146	157	153	145	157	165	..
	1879	..	171	..	179	179	173	170	177	181	..
bium mon- (Broad Wil- rb)	1875	..	..	161	..	163	..	..	175	..	..
	1876	..	175	163	..	173	..	..	178	187	..
	1877	..	177	..	167	165	168	..	170	174	..
	1878	159	..	176	166	161	..	..	161	..	..
	1879	..	175	..	171	178	180	..	177	..	..
a Ulmaria w-sweet)	1875	..	..	174	..	168	..	..	173	..	176
	1876	..	173	170	182	176	182	175	181	178	..
	1877	..	169	173	175	173	..	..	175	172	183
	1878	159	161	170	172	168	173	..	169	165	172
	1879	..	180	188	196	182	193	.	186	189	189
UREA NIGRA Knapweed)	1875	..	..	169	..	158	..	..	158	..	..
	1876	..	181	..	178	181	..	178	168	179	189
	1877	..	177	..	175	179	..	..	172	178	190
	1878	165	..	171	152	180	167	..	166	169	173
	1879	..	n	182	179	204	..	..	185	n	195
um verum r Bedstraw)	1875	..	..	177	..	175	..	..	176	..	..
	1876	..	180	198	185	179	..	182	179	190	..
	1877	..	181	..	183	178	..	..	180	..	190
	1878	..	..	..	191	179	180	..	173	188	185
	1879	..	188	..	197	195	199	..	196	202	196
uus arvensis Thistle) ..	1875	..	..	170	187	177	..	..	177	..	181
	1876	..	185	..	187	187	183	183	188	168	174
	1877	..	181	..	184	185	..	..	187	..	178
	1878	170	..	..	177	180	..	..	182	..	172
	1879	..	199	..	203	203	..	..	198	..	205
hus arvensis ow-Thistle)	1875	..	..	213	..	191	..	..	169	..	..
	1876	..	..	209	186	187	..	..	192	..	191
	1877	..	..	226	201	206	..	..	195	..	199
	1878	..	..	246	183	190	..	..	180	..	..
	1879	..	n	..	211	214	214	..	215	..	200
OLVULUS I (Greater- eed)	1875	..	..	187	212	191	..	..	..	..	188
	1876	..	199	184	187	193	..	..	198	..	211
	1877	..	188	199	185	206	..	..	198	..	218
	1878	..	..	166	182	195	..	..	191	..	211
	1879	..	210	194	197	222	..	..	213	..	235

ome into flower. At a place as far north as Parbold, in Lancashire, or Great Cotes in Lincolnshire, it would naturally be expected that plants should lower much later than in the south of England, but this has often not been he case. Babbacombe especially seems to be a very cold locality, for the lates of flowering there are almost invariably later than those at other places. The specimens sent often indicate earlier dates of flowering than

those recorded; but even taking this fully into consideration, it is certainly extraordinary how late plants are in that locality. Considering the small area, the variations of the dates sent from the different stations in Hertfordshire are noteworthy, and are far greater than might have been expected. Harpenden especially is a very cold spot. Doubtless much must be put down to the inexperience of observers, as it requires time to get properly accustomed to the work of recording observations; and by a glance at Table II., where only records which have been kept, for 3 years at least, have been taken, this variation is much corrected. From that Table also it will be observed how invariably later plants have been this year than in 1878 or previous years.

In Tables I. and II. the day of the year is given instead of the day of the month. The following figures will be useful in converting the former into the latter:—

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1	32	60	91	121	152	182	213	244	274	305	335
10	10	41	69	100	130	161	191	222	253	283	314	344
20	20	51	79	110	140	171	201	232	263	293	324	354
30	30	...	89	120	150	181	211	242	273	303	334	364

In Table I. the figures in large type indicate that the specimens were also sent with the return.

Notes on the Several Species.

1. Anemone nemorosa. **2.** April 1 "several flowers just open;" **4.** April 1, "at its height;" **5.** May 8 "last specimen seen;" **6.** March 25 "in flower;" ***8.** "flowers under-sized," specimen indicates a rather earlier date. **17.** April 21 "by;" **23.** April 22 "might have been out the day before;" specimen indicates a much earlier date; **A.** April 12 "in bloom, a specimen was gathered a fortnight before." The difference between Trusham and Sarum is very remarkable and also between Trusham and Parbold, where it is only one day later.

2. Ranunculus Ficaria. **1.** March 28 "a few;" **2.** March 6 "one specimen;" March 13 "only now becoming frequent, and still only in favourable situations;" **4.** March 7 "a considerable number on one bank, generally with one flower to a plant;" **5.** April 17 "in great numbers;" last seen May 23; **8.** April 2 "in flower;" April 15 "in bloom;" **9.** February 25 "first specimen seen;" **16.** March 13 "sparingly;" **22.** Uppingham, March 29 "one flower, frequent after April 11;" **24.** "very few of this flower opening in March;" **A.** March 20 "evidently out some days." Very late at Babbacombe and Parbold, late at Isleworth, probably owing to damp. The date for Harpenden seems very doubtful.

* These words are appended to all the notices, but as the dates are not very different from those of neighbouring stations, it is presumed that they are the dates of *first* flowering.

3. *Ranunculus acris.* **9.** specimens found April 24. At Bath there were "many deformities," it seems almost as if the Goldilocks (*R. auricomus*) had been mistaken for *R. acris;* the earlier flowers of *R. auricomus* are as a rule deformed. This plant is still confused with the proper *R. acris.*

4. CALTHA PALUSTRIS. **1.** April 17 "by;" **5.** April 8 "in abundance, judging by the flowers, must have been at least April 5;" **16.** April 26 "no appearance, in flower April 30;" **25.** between Colwyn Bay and Conway April 28; **A.** December 5, 1878; March 28 "full, 5 or 6 flowers running to seed;" **B.** May 19 "well out." This species, though a marsh plant, seems to be a good test of the backwardness of the season, or of the locality where it grows. Very late at Babbacombe, Isleworth, Harpenden, and Hertford; at more northerly stations it would naturally be more backward.

5. *Papaver Rhœas.* **8.** June 28 "flower and seed;" **14.** June 19 "Poppies out near Rye House."

6. *Cardamine hirsuta.* **2.** January 3 "no advance up to January 30," when there were a few closed stemless flowers in the centre of the rosette of leaves; **4.** February 28 "one flower rather opening than open;" March 9 "one plant;" Ilfracombe April 4 "very numerous;" **17.** April 21 "by." This is a difficult plant to watch, and the dates given are extremely variable, ranging over a space of 125 days. Specimens, when sent, show great variation, but from the very slow progress of vegetation it has been impossible to assign any dates to them.

7. *Cardamine pratensis.* Ilfracombe April 28; **9.** specimen found April 8. The specimen from Babbacombe indicates an earlier date, but the other specimens sent fully confirm those given in the Table.

8. *Draba verna.* **5.** April 21 "judging from the seed must have been out 10 days ago;" **16.** March 28 "in flower;" **13.** April 19 "some in seed;" **25.** West Kirby, March 19 "abundant on a warm sandy bank;" **A.** March 30 "some of the plants running to seed." In many localities this species was scarce this year, and consequently the dates are rather open to doubt. Like No. 6 it is a plant that requires very careful watching in its proper localities to secure the true first date of flowering.

9. *Viola odorata.* **8.** April 1 "in flower;" **20.** April 2 "fairly in flower;" **A.** cultivated. Very early at Harpenden, but otherwise fairly uniform in its time of appearance.

10. *Polygala vulgaris.* **2.** May 23 "by;" Torquay, May 9; **4.** May 23 "abundant in 2 places on the Downs;" **8.** June 19 "flower and seed;" **25.** Colwyn, "abundant June 1, 1,000ft. above sea;" **A.** June 2 at Cawston.

11. *Lychnis Flos-cuculi.* **8.** June 30 "in flower, first flower faded."

12. *Stellaria Holostea.* Ilfracombe April 17 "one flower;" **5.** May 8 "in great numbers;" **25.** Colwyn, April 27, "4 or 5 plants in a 20 miles' walk;" May 8 "beginning to flower" (April 7, 1878).

13. MALVA SYLVESTRIS. **8.** June 28 "many flowers but none withered;" **9.** "coloured bud June 21, flower June 28" (date adopted June 24); **16.** July 18 "about now full;" **23.** by July 25 "some in seed."

14. *Hypericum tetrapterum.* **4.** July 25 "several in a boggy place;" **8.** August 15 "a few faded" (entered August 13).

16. Geranium Robertianum. **2.** April 18 "one flower open on 2 plants on south wall. Buds not showing or else scarcely showing elsewhere; 21 one more flower open (same lane); 24 one flower more in a different spot; 27 flowering freely in all sunny lanes;" Ilfracombe May 5; **25.** Colwyn, May 25 "abundant" (April 28, 1878); **A.** June 3 "full."

17. Trifolium repens. **4.** by June 4; **24.** about June 24. The specimens from Uppingham and Hatton are in a rather younger state than those from other localities.

18. *Lotus corniculatus.* **4.** May 25, "possibly earlier, next specimen, June 4." Ilfracombe, May 13; **18.** by June 19; **23.** by June 22. The specimen from St. Albans was barely out, that from Ware indicated a rather earlier date. **25.** Colwyn, May 25 abundant (April 28, 1878).

19. *Vicia Cracca.* Torquay June 25; **8.** July 24, "in flower, but all blossoms still first flower;" **9.** coloured buds June 21, flower not till July 17. Specimens from Babbacombe, Salisbury, Isleworth, and Bocking, seem to indicate rather earlier dates.

20. *Vicia sepium.* Ilfracombe, May 5; **9.** coloured bud May 12, "flower not till May 20;" **B.** June 26 "well out." The specimen from St. Albans was not in flower.

21. *Lathyrus pratensis.* **18.** by June 19. The specimen from Babbacombe indicates an earlier date, and those from Salisbury, Ware, and Uppingham rather earlier dates.

22. Prunus spinosa. **4.** "some bushes slightly tinged" March 20, in flower April 1. Ilfracombe, "few open flowers," April 8; "scarce till April 21;" **16.** May 5 "in flower, but not general;" East Wickham, Kent, April 30 "in flower;" **23.** by May 11. The specimen from Harpenden indicates a date rather later, and that from Hatton a few days earlier. **25.** Colwyn, April 27 3 sprays seen; May 2 "beginning to flower" (same bush in flower March 29, 1878).

23. *Spiræa Ulmaria.* **13.** by July 23. The specimen from Babbacombe is rather advanced, indicating an earlier date.

24. *Potentilla anserina.* **25.** Colwyn, May 25, abundant (April 28, 1878.)

25. *Potentilla Fragariastrum.* **21.** April 8, "in bloom;" **22.** "several plants in flower, this the most advanced;" **A.** April 14 "several." The specimens from Ware and Uppingham indicate earlier dates.

26. *Rosa canina.* **22.** June 26 "one solitary specimen, another on June 30; frequent July 1;" **23.** July 1 (gathered by another person June 29). This plant is again this year remarkable for its uniformity in the time of flowering at all stations.

27. *Epilobium hirsutum.* Farnborough, July 25, plentiful. The specimen from Babbacombe was very far advanced.

28. *Epilobium montanum.* Torquay, June 20, several.

29. *Angelica sylvestris.* The specimen from Bocking indicates an earlier date.

30. *Anthriscus sylvestris.* Ilfracombe, April 23; **9.** specimen seen April 24, flower May 5. The specimen from Hatton indicates an earlier date.

32. *Galium Aparine.* **14.** June 7 "one specimen, many at Tornsell;" **18.** by June 19, "very tall and abundant;" **23.** by June 27.

33. *Galium verum.* **22.** July 19 "date back 2 days."

34. *Dipsacus sylvestris.* **2.** by August 12, "several plants with heads in every stage of flowering."

35. *Scabiosa succisa.* **2.** by July 30, "several heads flowering freely in water meadows;" **13.** July 16 "out a few days."

36. *Petasites vulgaris.* **8.** April 15, "some flowers faded, covered by water till recently;" **16.** April 19, full; **22.** by March 31; it was long after March 31 before I saw another specimen in flower."

37. TUSSILAGO FARFARA. **1.** by April 18; **16.** March 7, "full flower;" **10.** "between the first and second week in March;" **22.** March 13 "had been in flower a day or two;" **23.** by April 11, "must have been in flower some days;" **25.** February 17, "one flower;" Bagillt, March 3, "a few half open;" March 7, "abundant" (February 19, 1878); Lewisham, February 19, "quite yellow."

38. ACHILLEA MILLEFOLIUM. **16.** July 18 "about now full;" **A.** also December 9, 1878. Specimen from Babbacombe indicates a rather earlier date.

39. *Chrysanthemum Leucanthemum.* **1.** by May 28; **8.** June 19 "in bloom;" **18.** by June 19.

40. *Artemisia vulgaris.* **8.** August 10, "not in flower long."

41. *Senecio Jacobæa.* **8.** June 28, "plentifully out, but all fresh;" **16.** July 3 "full."

42. CENTAUREA NIGRA. **1.** By August 10; Torquay by June 24; **4.** July 7, "plentiful in a wet field;" **21.** July 8, "bloom."

44. *Carduus arvensis.* **8.** "long time in bud."

45. *Sonchus arvensis.* **2.** "by July 25, plants flowering generally in sunny corn fields;" **4.** August 9, "several had the first head in seed;" **24.** "about" July 19.

46. *Hieracium Pilosella.* **22.** June 13, "had been out 2 or perhaps 3 days;" **23.** "bud" June 6; **B.** June 24 "out a few days." The variation in the time of flowering at the different stations is extraordinary.

47. CAMPANULA ROTUNDIFOLIA. **4.** June 30, next July 7; in 1874 "in flower for some days" June 30, in all other years did not flower till July; **8.** July 22 "plentiful, flowers all apparently first;" **21.** July 13, not again until August 1.

48. *Gentiana campestris.* **9.** not out before August 17, no specimen found before October 13.

49. CONVOLVULUS SEPIUM. **1.** "by" August 21; Toynton, Spilsby, July 27; **8.** "plants luxuriant." Plants generally luxuriant but with very few flowers.

51. *Pedicularis sylvatica.* **2.** April 24 "several plants well in flower on

level heath;" Ilfracombe, May 2; **8.** July 19, "out about 10 days;" **25.** Colwyn, May 25, "abundant" (April 28, 1878); **A.** June 2 at Cawston. An enormous variation between the time of flowering at the different stations.

52. *Veronica Chamædrys.* Ilfracombe, April 23, May 2; East Wickham, Kent, April 30, "flower just visible;" **7.** remarkably early; **25.** Colwyn, May 24, one specimen (same spot, April 24, 1878).

53. *Veronica hederifolia.* **A.** April 16 at Lyng.

54. *Mentha aquatica.* **4.** "plentiful in one ditch August 12;" **9.** not out by August 17, a few found September 14.

55. *Thymus Serpyllum.* Torquay, June 13; **B.** June 29 "almost out."

56. *Prunella vulgaris.* **4.** June 28, "several and well in flower;" **B.** July 1 "well out."

57. *Nepeta Glechoma.* Ilfracombe, April 4, "abundant;" **16.** April 28, "in flower;" **25.** Colwyn Bay, April 26, "out abundantly;" **A.** April 16 at Lyng.

58. *Galeopsis Tetrahit.* **4.** July 19, "must have been in flower some days;" **9.** a specimen seen July 1.

59. *Stachys sylvatica.* Torquay, by June 24; **22.** June 30 "a solitary specimen, but that well out."

60. *Ajuga reptans.* **2.** May 7, "well in flower in one or two spots, elsewhere still in bud;" Ilfracombe, April 30; **15.** "by" June 13. Specimen from Babbacombe indicates a much earlier date; very late at St. Albans; **25.** Colwyn, June 1.

61. Primula veris. **8.** "First flowers on plant in uncultivated state in garden;" **19.** April 13 cultivated; **25.** Colwyn, April 23, "coming into bloom;" **A.** May 18 "abundant."

62. *Plantago lanceolata.* Ilfracombe, April 22; **22.** specimen found on May 9, next by May 20.

63. *Mercurialis perennis.* **2.** 2 or 3 barren open, December 2, 1878; March 2 (barren), fertile April 8; **4.** March 6 (barren), March 18 fertile; **5.** April 5, "seen in hundreds;" **8.** March 20 (barren), fertile April 1; **16.** May 1 "in full flower;" **21.** one plant, not in flower till 26; **22.** March 16 (barren) "one or two flowers only open, remained in this state until April;" **A.** April 3 (barren). Specimens from Babbacombe and St. Albans indicate earlier dates.

64. *Ulmus montana.* **1.** March 28, "in flower," specimen indicates an earlier date; **4.** March 21, "elm trees in Close well in flower;" **16.** April 21, "in full bloom;" **23.** elm April 11; Lewisham, March 21, "elms generally in bloom," first seen March 17; **A.** Common elm in bloom March 30.

65. *Salix caprea.* **1.** March 28, "in flower;" **5.** April 5 "in full blossom;" **23.** "by" April 6; between Queensferry and **25.** March 31; **A.** March 28 (barren), April 5 (fertile).

66. *Corylus Avellana.* **1.** March 8, fertile by March 28; **2.** by January 31, "2 or 3 strong bushes full of barren catkins, mostly showing all their stamens, elsewhere throughout the district the hazel catkins are still very

small, and far short of flowering;" **3.** January 31 (barren), February 2 (fertile); **4.** fertile January 17, barren January 31; **5.** March 11 "about 50 seen" (75); **8.** February 12 (barren), February 18 fertile, very luxuriant specimens; **16.** February 20 "in flower;" **13.** February 12 "many seen;" **10.** February 15 "fertile flower;" **19.** "male flower;" **21.** February 19 "male and female;" **22.** February 16 "male and female;" **23.** February 27, both male and female on one bush; **24.** "first week in February;" **25.** February 28 "beginning to open;" Lewisham, February 16; **A.** February 17 (cultivated), March 2 (wild).

67. *Orchis maculata.* **2.** by June 16, a considerable number of plants in a bog with quite half their flowers open, in neighbouring parish; **5.** very early; **13.** by June 24, "had probably been out a day or two;" **15.** "by" June 19; **25.** Colwyn, May 16 "several plants."

68. *Iris Pseud-acorus.* **2.** June 9, "a considerable number of flowers open in neighbouring parish;" **22.** June 28, "several fully out, some faded date back some days;" **25.** Prestatyn, June 12.

69. *Narcissus Pseudo-narcissus.* **5.** 50 seen March 11, great numbers April 5; **14.** double one, March 28; **19.** cultivated; **A.** March 30 at Elsing.

70. *Galanthus nivalis.* **2.** cultivated February 7; wild February 15; Alderbury, February 8; **8.** cultivated; **17.** "by" March 15; **12.** March 11 "last appearance;" **19.** cultivated; **22.** cultivated; **23.** "in flower" February 11 (cultivated); **25.** Colwyn, March 1, "beginning to open in the garden;" Lewisham, February 8.

71. *Endymion nutans.* **1.** bud April 26; specimen sent May 5, rather advanced; **2.** May 7, "well in flower in one or two favoured spots;" Ilfracombe, April 23, May 2; **17.** "specimen found," April 21, May 5; **25.** Colwyn May 24 "many."

Frog Spawn. **4.** Must have been laid nine days, February 27; tadpoles very small, March 21; tadpoles with hind legs, June 7. **7.** tadpoles, April 2. **8.** March 6. **12.** March 9, in quantity. **14.** April 10, not in usual quantity. **16.** March 13. **20.** March 16. **24.** March 7. Orpington (near Bromley), March 8.

Dates of Foliation, Isleworth, 1879.

Horse Chestnut. The first leaflets began to expand on April 5, but (unlike last year) were not more forward in the wet ground by the Thames than elsewhere. Trees sprinkled with leaves on April 13, but the leaves were subsequently pinched, and in some cases browned at the edges by the fall of temperature at the beginning of May (min. on grass 21°, May 2). Leafage established May 16; very luxuriant May 25.

Sycamore. Two trees in leaf April 26; trees in full leaf May 16; very luxuriant May 25.

MAPLE. Leaves about a third expanded May 9; not generally of full size May 25; fully expanded June 5.

HAWTHORN. No leaves noticeable anywhere on March 7; leaves ¼ in. long on some bushes April 8; many bushes in leaf, but not luxuriantly, April 30; generally in leaf May 4; in thick foliage May 22.

ASH. Buds bursting, but no leaves expanded, May 12; leaves beginning to appear, but still folded, May 16; trees sprinkled with leaves May 29; in leaf June 6.

OAK. Buds generally bursting May 8; some trees with small leaves, others still only with buds bursting, May 16; in leaf June 6.

ELM. A few leaves beginning to expand April 25; leafage spreading upwards (as usual) very slowly, and trees not sprinkled with leaves till May 4; in leaf, but leafage not full-sized or fully coloured, May 25.

BIRCH. A few trees lightly sprinkled with leafage April 20; foliation very unequal in progress, some trees being almost in leaf, others not showing leafage, April 26; in leaf, or sprinkled with leaves, May 12; in full leaf May 25.

BEECH. Buds bursting, and leaves slightly appearing, May 4; many trees in leaf May 16; the advance of foliation on this species of tree being remarkably rapid this year.

LIME. A few buds bursting on trees that had been trimmed April 20, but trees not sprinkled with leafage, and in many cases still only with opening leaf buds, on May 4; in full leaf May 25.

ALDER. Some trees with leaves about 1 in. long, others still with no leaves expanded, May 2; sprinkled with leaves May 22; in leaf June 4.

From the above notes it appears that, with the exception of the Beech, the dates of foliation of all the trees have been later than in 1878, this difference being greatest in the early stages of leafage of three of the species which are the earliest in the year to burst their buds—namely, the Horse Chestnut, the Hawthorn, and the Elm.

The commencement of foliation in the Horse Chestnut was 86 days later; in the Hawthorn 46 days; and in the Elm 15 days later than last year—the foliation in these cases being respectively 16, 18, or 20 days later than last year. Of the Sycamore and Maple, the commencement of foliation is so much affected by situation, that it is difficult to give a satisfactory return. The established leafage was in the case of the Sycamore almost coincident in date with last year, that of the Maple 12 days later.

With Ash the first bursting of the buds was 10 days later, and with Oak 15 days later than last year; both trees might be considered in leaf on June 6, that is, 10 days later than May 27, on which day both Oak and Ash were in leaf last year. There was this difference, however, that in 1878 the early leafage of the Oak burst from unusually large buds, and was remarkably luxuriant both in commencement and development.

The other trees noticed were a few days later in development than in 1878, with the exception of the Beech, which although rather later than last year in commencement of foliation, was a few days earlier in leaf, the ex-

cessively rapid progress of the leafage being intermediately very noticeable. The characteristics of the weather were, as elsewhere, long continued low temperature, with clouded skies, little direct sunshine, and much rain; the minimum temperature of the district being generally lower than that of the surrounding neighbourhood, taking a radius of about 8 miles.

The mean of the earth temperatures, at 1 foot and at 2 feet beneath the surface were respectively, in January, 33°·7 and 36°·2; in February 37°·1 and 38°·2; in March 40°·1 and 40°·6; the thermometer 1 foot deep remaining between 32° and 33° from January 12 to February 6.

During the summer the maximum shade temperature has (as far as my own observations go) only been between 70° and 79° on 16 days, 78°·2 being the maximum shade temperature of the year.

This weather has been accompanied by dense leafage, and luxuriant growth of the trees generally; the partial discoloration and fall of the early leafage which occurs in some years a little after midsummer (and especially on the Lime and Elm) was not observable; the autumnal change of tint in all cases commenced late, and the appearance of the trees was not much altered by October 1, excepting as regards the Limes, and in a less degree Birches and Horse Chestnuts.

Of these the Limes (which last year commenced to change on July 21) this year first changed slightly on September 2, were turning yellow by September 8, but the change was not established generally till September 28.

Birches were a few days later than last year, the autumn change then commencing on the 15th, this year on September 18; it should, however, be noticed that last year the change in the Birch commenced on July 21, and was checked by the heavy rainfall.

Horse Chestnuts began their autumn change on September 20, nearly a month later than last year.

By October 1 of this season there was an alteration in colour in the older leaves of some Oaks, and in some other instances, but the autumn tints were not prevalent; and in many Oak and Elm trees the long growth of summer shoots at that date still carried light green leafage.

Acorns in the district are few, and late, and there is not much crop of fruit on the Horse Chestnuts; the fruit of the Ash-tree, on the contrary, (commonly known as keys) is on some trees strikingly abundant.

Apples and Pears show marks of injury from the hail of the storm of August 2, large holes (or fissures in some cases) being made into the fruit.

In regard to the effect of temperature on Insect life, by experiment made during the early part of the year it appeared that the larvæ and pupæ of various species of the common Garden and Farm Insects were not in the slightest degree injured by cold, frequently indicated by readings of the minimum thermometer between 26° and 16° and lower, on one occasion 8°·8, the larvæ examined being in some cases frozen stiff when found.

In the summer the general hum of insects in the air hardly occurred; only doubtfully on one day, excepting close to Lime trees in flower; also the flight of winged Ants, which usually takes place (almost to a day) on August

14, did not take place till various dates in September—excepting in a single case in a Vinery on August 27.

With regard to the effects of the long-continued cold of the winter on human health, it appears from the Sanitary Report that in this district the death rate per 1000 was (not including strangers dying in the Brentford Workhouse): in December 1878, 21·7; January 1879, 32·13; February 27·87; March, 16·6; April, 20·4; bronchitis being prevalent during January, bronchitis and inflammation of the lungs during February and March, and catarrhal affections during April.

State of Foliation from Isleworth to Reading, May 24, 1879.

The observations of foliation were made one day earlier than in last year between Isleworth and Reading, and show the leafage to have been much less advanced than in 1878. The notes are consequently fewer, some species of trees being still entirely leafless, and others very little advanced.

Between Isleworth and Hounslow. Elm in leaf, but leaves still small. Lombardy Poplar and Pear in leaf. Apple in bloom; Pear still with flower; Plum blossom past.

Between Hounslow and Feltham. Horse Chestnut, Sycamore, Pear, and Lombardy Poplar in leaf. Hawthorn in full leaf. Alder, leaf moderate. One Oak in leaf. Pears in luxuriant bloom. Peas and corn patchy. *Rumex acetosella* very plentiful.

Between Feltham and Ashford. Horse Chestnuts and Limes in good leaf; the Horse Chestnuts the most advanced in foliation. Cherries in leaf. Corn patchy.

Between Ashford and Staines. Willows, Elms, and Lombardy Poplars in leaf. Young Pines looking brown.

Between Staines and Egham. Hawthorn, Lombardy Poplars, and Horse Chestnuts in good leaf, and leafage of orchard trees also fair. Willows in moderate leaf, and Walnuts sprinkled with leaves.

Between Egham and Virginia Water. Oak and Elm in moderate leafage, about equally advanced. Oak the most forward on elevated spots, and both trees more forward than in other localities. Hawthorn foliage sickly. *Stellaria holostea*, *Veronica Chamædrys*, and *Chærophyllum sylvestre* in flower.

Between Virginia Water and Sunningdale. Birch not luxuriant, but with large numbers of small leaves. Alder about half covered with leafage. Oak sprinkled with leaves. Pines beginning to shoot, but not healthy on the Heath in the neighbourhood of the water. First flowers on Yellow Broom. *Caltha palustris* and *Cardamine pratensis* in flower.

Between Sunningdale and Ascot. Beech, Birch and Larch in leaf. Pines shooting well. Oaks sprinkled with leaves. Some Yellow Broom in flower.

From Ascot to Bracknell. Birch with plentiful but small leafage. Oak buds bursting, or trees sprinkled with leaves. Mountain Ash not fully in leaf. Pine and Larch luxuriant; Spruce Fir poor, in hollows. Wild Hyacinths and Primroses, also *Cardamine pratensis*, in flower.

Between Bracknell and Wokingham. Lime and Willow in leaf. Elm in moderate leaf. Oak still bare in places, in other spots in leaf. Ash and Oak side by side well sprinkled with leaves. Ash most advanced. Apples in bloom. *Stellaria holostea* and *Veronica chamædrys* in flower.

From Wokingham to Earley. Horse Chestnut, Beech, Elm and Larch in good leaf. Hawthorn rather yellow. Cowslips in flower; but little Apple blossom observable.

Earley and Reading. Larch in fair condition, also Sycamore, Willow, Elm, Hawthorn, Birch and Scotch Fir in leaf. Walnuts sprinkled with leaves. Gorse in bloom, also Yellow Broom and *Caltha palustris* in flower.

Whether in respect of the development of foliage, or expansion of flowers, the dates were markedly later than in 1878.

Spanish Chestnut "in leaf," in sheltered positions, and *Robinia Pseud-Acacia*, sprinkled with leafage on May 25 last year, were not noticeable in any place on this occasion. Oak—last year varying from a sprinkling to luxuriant leafage—was now varying from complete bareness to a sprinkling in a few places, and moderate leafage between Egham and Virginia Water, where it is remarkable that in this as well as the last season the Elms and Oaks were about equally advanced in leafage at the time of observation.

Elm, which last year was frequently in full leaf, and in some cases with the deep green of the summer tints, had now barely full-sized leaves, and not fully coloured in the foliage.

Ash Trees, 2 Walnuts—moderately in leaf last year—were now hardly noticeable.

In the case of Birch, the leaves, though plentiful, were still small.

On May 25 last year the Hawthorn had been in bloom, and was still partially so; this year the blossom had not expanded, and the wild flowers were mainly those of the early kinds continued beyond the usual dates.

Report on the Entomological Observations. By the Rev. Charles H. Griffith, B.D., F.M.S.

In making my report, the first thing that attracts my attention is the great disparity of dates of the first appearance, or rather perhaps of the first observed appearance, of the different species. Taking for instance *Apis mellifica*. This insect was first observed at Strathfield Turgiss on January 8, whereas its first recorded appearance at Downside, near Bath, was April 17. It is hard to account for this; surely temperature can have nothing to do with it; at all events, with a difference of more than 8 months in the recorded first appearances but little can be gained in reference to the elucidation of facts in climatology. I do not wish to find fault with my staff, but I am inclined to think that, with a few notable exceptions, their observation of insect appearances is not sufficiently systematic. At this station the practice has been for some years to make a Table of the earliest probable time of appearance of each species, and then a sharp look out is maintained at that

time until the insect is observed. I cannot believe that April 17 can be the first day on which *Apis mellifica* was abroad in Bath; it can only be date of the first time it was seen. A little closer observation would doubtless have detected it earlier. The dates of none of the species are sufficiently well marked to hazard any remarks in consequence on climate, local influences are of course great, but I think they ought not to differ so much as they do. The two most notable occurrences of this most dismal year, the very worst season (I cannot call it summer, there has been no summer) I have ever known, although I have collected for more than 25 years, have been the swarms of *Pyrameis cardui* and *Plusia gamma*. At Strathfield Turgiss both these species have been wonderfully numerous, especially the latter, which has absolutely swarmed. About June 8 at Strathfield Turgiss but few butterflies were to be seen, but every one that was seen was the Painted Lady, and again about August 15 they were exceedingly abundant. The *Plusia gamma* was not remarkable for its frequent appearance until August 20, and then it literally swarmed. I find that *Pyrameis cardui* has been generally abundant, especially in North Lincolnshire, the "wolds," Great Cotes, &c., and not only at home but at Angers, Nancy, Rouen, and Angoulême they have appeared in clouds, and at Turin and in Switzerland perfect swarms have appeared, as well as in Spain and Würtemburg. This is very singular and difficult to account for. All the *Vanessidæ* are liable to appearances in these numbers, the Painted Lady having been most abundant in 1741, 1826, 1857. Of 1846 it is commonly said to have been the Camberwell Beauty year, and again in 1872; some of these years were peculiarly warm or bright, but 1879 was neither warm nor bright. Whence then these swarms? I have only observed one specimen of *Colias Edusa*, on September 20; a male, but I failed to secure it.

Appended is a summary of the observers' notes for the year; that from Marlborough is so admirable, complete, and valuable that the list of butterflies is printed *in extenso*.

79. *Trichocera hiemalis* observed on almost every mild day throughout the year.

74. *Apis mellifica*. Strathfield Turgiss, January 8; Isleworth, January 18; Ware, February 8; Hatton, February 9; Odsey, February 9; Cardington, February 28; Uppingham, February 28; Trusham, March 2; Great Cotes, March 6; Babbacombe, March 8; Downside, April 17.

76. *Pieris Rapæ*. Uppingham, March 7; Strathfield Turgiss, March 8; Odsey, March 19; Marlborough, April 8; Downside, April 8; Trusham, April 24; Ware, April 26; Babbacombe, April 27; Yeovil, April 28; Bromley, April 29; Isleworth, May 2; Great Cotes, May 2; Watford, May 8.

75. *Pieris Brassicæ*. Harpenden, April 22; Trusham, April 29; Watford, May 5; Strathfield Turgiss, May 5; Marlborough, May 28; Great Cotes, May 31; Uppingham, June 14; Isleworth, July 29.

78. *Bibio Marci*. Strathfield Turgiss, May 5; Isleworth, May 17; Babbacombe, May 22; Chester, May 28.

72. *Melolontha vulgaris*. Marlborough, May 20; Strathfield Turgiss, May

23; Bishop Frome, June 4; Uppingham, June 5; Isleworth, June 6; Downside, June 6; Odsey, June 7; Babbacombe, June 10.

77. *Epinephile Janira.* Harpenden, May 4; Uppingham, June 14; Hertford, June 16; Bishop Frome, July 3; Strathfield Turgiss, July 4; Babbacombe, July 6; Marlborough, July 11; Great Cotes, July 15; Isleworth, July 17.

Gonopteryx Rhamni. Cardington, March 2; Yeovil, March 3; Strathfield Turgiss, March 5; Marlborough, March 6; Addington and Salisbury, March 7; Trusham, March 19; Downside, May 8; Uppingham, May 9.

Anthocharis Cardamines. Bishop Frome, May 19; Strathfield Turgiss, May 21; Hatton, May 25; Marlborough, May 31; Downside, June 6; Uppingham, June 17.

Vanessa urticæ. Uppingham, March 8; Marlborough, March 11.

Vanessa Io. Strathfield Turgiss, March 6; Uppingham, March 10; Bishop Frome, May 19.

Pyrameis Cardui. Strathfield Turgiss, June 3; Babbacombe, June 4; Marlborough, June 6; Bishop Frome, June 12; Great Cotes, June 18; Downside, July 11.

BUTTERFLIES OBSERVED AT MARLBOROUGH.

G. Rhamni, March 6, June 18.
P. Brassicæ, May 28.
Rapæ, April 3.
Napi, May 4.
A. Cardamines, May 31.
A. Galathea, July 30.
L. Ægeria, May 19; July 18.
Megæra, June 10.
H. Janira, July 11.
Tithonus, August 5.
Hyperanthus, July 15.
C. Pamphilus, June 6.
L. Sibilla, August 2.
A. Iris, August 2.
C. Cardui, June 6; August 4 plentiful, but not remarkably so.
V. Atalanta, March 19.
V. Io, March 8.
Polychloros, March 19; May 14.
Urticæ, March 11; May 23.
A. Paphia, July 18.
Adippe, August 4.
Aglaia, August 4.
Selene, June 18.
Euphrosyne, June 18.
T. Rubi, June 18.
C. Phlæas, June 4.
P. Alsus, August 1.
Alexis, June 11.
Agestis, September 14.
T. Alveolus, June 4.
Tages, June 4.
P. Linea, August 1.
Sylvanus, June 21.

Report on the Ornithological Observations. By JOHN CORDEAUX.

OBSERVATIONS have been received from 25 stations in England and one in North Wales, against 21 in 1878. Of last year's observers 19 have sent in reports, and 2 only have failed to do so. On the other hand, it is satisfactory to find that 7 ornithological reports have been sent in from new localities—namely, Downside College, near Bath, Dalston, near Carlisle,

Bromley, Kent, Hertford (2 stations), Limpton, near Welwyn, and Bocking, Essex.*

All but one of the returning stations are situated south of the Humber, and it is a matter of regret that there are so few observers in the north of England; such returns, there can be no doubt, would add much to the interest and completeness of the annual report.

The ornithological notes extend over a year, from the commencement of October 1878 to the end of September 1879.

For convenience the notes have been divided under the same headings as last year, namely *song*, *migration*, *nesting*, also *general remarks*.

(1.) SONG.

SKYLARK (*Alauda arvensis*). The skylark was heard singing for the first time at **2.** February 12; **7.** February 7; **9.** February 4; **6.** February 9; **13.** February 9; **14.** February 15; **19.** February 7; **16.** February 14; **22.** February 8; **23.** February 9; **24.** February 16.

Appears to have been generally in song at both the southern and more northern stations during the second week in February. Taking 11 stations against 10 in 1878 the lark was a fortnight later in commencing its song, Earliest recorded, Marlborough, February 4. Latest, Great Cotes, February 16. At Cardington, on November 26 and 27, 1878, larks are noticed as "singing a short time in the morning." At Hatton, Lincolnshire, they continued to sing to November 18 in the same year.

GREAT TITMOUSE (*Parus major*). Spring notes first heard on February 4 at **9**; on February 7 at **21**; latest at **24** February 20.

BLACKBIRD (*Turdus Merula*). Singing at **20** February 8; at **24** February 21; "early morning, daylight;" at **25** March 9.

SONG THRUSH (*Turdus musicus*). Singing: **2.** February 10; **4.** February 21; **7.** February 10; **10.** February 16; **13.** February 10; **21.** February 14; **19.** February 12; **20.** February 6; **14.** February 8; **22.** February 27; **25.** January 30; **23.** February 16; **24.** February 7.

Song commenced at 13 stations from January 30 to February 27. Earliest at Chester, January 30; Cardington, February 6; and Great Cotes, February 7. At Trusham, Devon, February 10; Strathfield Turgiss, same day; Salisbury, February 21.

On an average the song commenced earlier at the northern than at the southern stations.

NIGHTINGALE (*Daulias luscinia*). Song first heard **7.** April 15; **6.** April 23; **8.** April 23; **10.** April 19; **13.** April 23; **12.** April 22; **14.** April 19; Limpton, near Welwyn, April 23; **21.** May 21; **19.** April 24; **18.** April 24; **20.** April 29; **22.** May 1; **24.** "first week in May."

Returns from 14 stations show the Nightingale's song was heard from April 15 at Strathfield Turgiss, Hampshire, to May 21, at Bishop Frome,

* Since the Report was in print notes have been received from two new localities, viz. Belton, near Grantham, and Sparham, Norfolk; but these were too late for insertion in the present Report.

Herefordshire, May 1, at Uppingham, and the first week in May at Great Cotes. Comparing 12 stations in 1878 against 14 in 1879, we find that the average of the Nightingale's song was about 6 days later in the past season.

The observations taken this year tend to confirm the remark made in the report for 1878, that the line of migration of this species is from SE to NW, the birds gradually spreading northward and westward after reaching our shores, till they attain the limits of their range in these directions.

The range of the Nightingale has this season extended further northward on our east coast than is usually the case. There have been numerous instances of their occurrence in several localities both in North Lincolnshire and Holderness.

Willow Wren (*Phylloscopus trochilus*). **5**. April 9; **6**. April 15; **21**. April 18; **25**. April 23; **23**. April 21; **24**. April 19. Song heard earliest at Downside, April 9. Latest, Hatton, and Great Cotes, Lincolnshire, and Chester.

The Willow Wren appears to arrive very regularly year by year, on an average during the second week in April, and often on the same day in localities very wide apart. Their song was heard about a week later this year than in 1878. A Willow Wren is recorded from Uppingham on February 11. This requires confirmation, perhaps the bird was a late Chiffchaff; one such was sent to us, captured in a room into which it had flown, on December 7, 1878, at Healing, near Grimsby.

Cuckoo (*Cuculus canorus*). First heard. **1**. April 30; **2**. April 21; **3**. April 15; **4**. April 27; **7**. April 14; **5**. April 18; **9**. April 19; **8**. April 18; **10**. April 21; **13**. April 25; **12**. (two stations) April 18-22; **14**. April 22; Limpton, April 25; **21**. April 24; **19**. April 26; **18**. April 19; **20**. April 28; **16**. April 16; **22**. April 12; Colwyn Bay, May 4; **23**. April 29; **24**. April 24; "Lincoln," April 24; one passed the light ship at the Tees mouth on April 26, from SE to NW.

Returns from 28 stations show that the Cuckoo was heard between April 12 at Uppingham; April 14, Strathfield Turgiss, and April 29, at Hatton, Lincolnshire; May 4th, Colwyn Bay; and April 30, Babbacombe, Torquay.* The observations taken bear out our remarks of last year, that the line of migration of the Cuckoo is from SE to NW,† and that it gradually spreads northward and westward. An average of 23 stations in 1879, against 18 in 1878, shows that the note was heard this spring one day earlier.

At Hatton, Lincolnshire, the Cuckoo was last heard on July 6; at Bath, on June 16; at Uppingham, June 16, "changed note," "also on 20," "but note not changed on 26 and 28;" at Isleworth, June 23, "Cuckoo singing with full notes both in afternoon and evening."

* It is a somewhat curious circumstance that these were the latest stations for the Cuckoo in 1878.

† *Errata*.—In the notes for 1878, Vol. V. p. 60, l. 39, for "warmest" read narrowest; for "SW" read NW.

Corncrake (*Crex pratensis*). **9.** May 9; **20.** May 20; **22.** May 6; Colwyn Bay, April 28. Heard first at Colwyn Bay both in 1878 and 1879.

(2). Migration.

Chimney Swallow (*Hirundo rustica*). First seen: **1.** May 16; **2.** April 29; **4.** April 30; **7.** April 13; **5.** April 7; **9.** April 4; **8.** April 13; **10.** April 19; **13.** April 7; **12.** April 16-21 (two stations); **14.** April 18; Limpton, April 25; **21.** April 24; **19.** April 25; **20.** April 23; **16.** April 8; **22.** April 15; **23.** April 23; **24.** April 22. On April 8, 9, and 10, at four stations in North Wales and Anglesea.

There are 23 stations with returns of the first appearance of the Swallow; the earliest returns are from Marlborough, April 4, and Downside and Harpenden, April 7th; and certain localities in the north-western corner of Wales; latest from Babbacombe (Torquay), May 16; this most southern station having returned the latest arrival in 1878, namely, May 10. The coincidence may possibly be due to some local cause. Taking the average of the 23 stations against 16 in 1878, it appears that the Swallow arrived about 2 days earlier in the present than in the last season.

At Downside, May 13, Swallows were "building;" at Hatton, Lincolnshire, July 26, "young swallows able to perch;" Isleworth, September 15, "collecting for migration;" Downside, September 15, "last seen;" Dalston Vicarage, September 25, "in flocks."

House Martin (*Hirundo urbica*). First seen at **2.** April 27; **5.** April 20; **9.** April 2; **21.** May 5; **23.** April 23; **24.** May 9.

Earliest at Marlborough, April 2; latest at Great Cotes, May 9; last seen at Downside, September 16.

Both *Hirundo urbica* and *rustica* very numerous at Great Cotes up to the end of September, and many were observed also during the first week in October.

Swift (*Cypselus apus*). Was first seen at **7.** April 18; **5.** May 8; **9.** April 30; **10.** May 14; **8.** May 24; **13.** May 14; **21.** May 7; **19.** May 23; **22.** May 10; Colwyn, May 17; **23.** May 19; **24.** May 16; Ilfracombe, May 6.

Earliest at Strathfield Turgiss and Marlborough, which two stations also made the earliest returns of this species in 1878. Latest at the more northern localities.

Chiff-chaff (*Phylloscopus collybita*). First heard or seen at **7.** March 20; **9.** March 18; **10.** March 29; Limpton, April 14; **21.** March 30; **20.** April 4; **16.** March 28; **25.** April 2; **23.** April 21; **24.** April 2.

On the same day at Chester and Great Cotes, April 2; not recorded at Hatton, Lincolnshire, before April 21; in this case was probably overlooked, as we know it was observed, near Horncastle, in Mid-Lincolnshire, in some numbers on the 3rd of that month.

Flycatcher (*Muscicapa grisola*). First appearance at **9.** May 26; **6.** May 16; **21.** May 21; **19.** May 23; **16.** May 11; **23.** May 17; **24.** May 20; earliest at Uppingham and Bromley, latest at Marlborough and Odsey.

TURTLE DOVE (*Columba Turtur*). First appearance **9.** May 29; **10.** May 20; **21.** May 18; **24.** May 27; about a fortnight later than in 1878.

FIELDFARE (*Turdus pilaris*). At Cardington, in 1878, Fieldfares arrived on October 29; at Great Cotes, on October 23; at Bath, last seen in the spring of 1879, on April 16; "flock of 200." At Bishop Frome, April 24, "several seen."

WOODCOCK (*Scolopax rusticola*). On the night of October 30, or early morning of 31, there was a large arrival of Woodcocks on the Yorkshire and Lincolnshire coast. Sixty were shot at Spurn Point on the morning of the 31st; wind NE, moderate to strong. The birds seem to have been much exhausted by their passage.

(8.) NESTING.

SONG THRUSH (*Turdus musicus*). **7.** March 26 "first eggs," April 8 young; **5.** April 15 "Nest of Thrush and Blackbird found with addled eggs;" April 20 "Hatched;" **8.** March 22 "Nest with 3 eggs;" **16.** April 18 "ready to leave nest;" **9.** April 2 "5 eggs in nest;" **24.** April 15 "eggs." **25.** Under date April 20 the Thrush is reported as quite near, presumably in consequence of the severity of the late winter.

Both Thrush and Blackbird later in nesting. A large proportion of the first eggs of both species was destroyed by the wet and cold Spring.

ROOK (*Corvus frugilegus.*) Building: **4.** March 4 "building;" **7.** February 7 "building;" **8.** February 9 "beginning to repair nest;" March 30 "sitting;" **13.** March 1 "building;" **12.** March 1 "building;" **14.** March 8 "building;" **19.** February 26 "building;" **16.** March 7 "building;" **22.** March 9 "building;" **25.** March 9 "began to build same day and same branch of tree as in 1878." A week later in nesting on the average than in last year. Earliest at the most southern stations.

GENERAL REMARKS.

The CIRL BUNTING (*Emberiza Cirlus*) was heard singing at Bishop Frome on April 4. Any information regarding the nesting of this species would be very interesting. It appears to be confined to the south-western counties in England, and even there is very locally distributed in the breeding season.

The observer at Hatton, near Wragby, is correct in supposing the Pied Wagtail, the *Motacilla lugubris* of Temminck, is found in Lincolnshire during the winter; in all but some of the more northern counties examples may be found throughout the year.

The "Yellow Wagtails" observed in the same locality in the winter months, are not our common Yellow Wagtail, the *M. Raii* of Bonaparte, which is a regular spring migrant to this country, coming about the middle of April and leaving again in September; they belong to another British species, the Grey Wagtail, *Motacilla Sulphurea*, Bechstein, these are only autumn migrants to

the southern and eastern counties, leaving again in the spring.* This species is much more aquatic in its habits than the common Yellow Wagtail.

The SNOW BUNTING (*Plectrophanes nivalis*) was taken for the first time at Marlborough shortly before January 1 this year.

The severity of the winter of 1878-79 caused an almost unprecedented mortality amongst birds, great numbers of various species succumbing to the cold. This mortality was perhaps most apparent amongst the *Turdidæ* and the Starlings. Spring brought little or no improvement; birds did not nest till much later than their average time, and in a vast number of instances the first eggs were addled and destroyed by cold rains, and an abnormally low temperature. From Marlborough it is remarked "eggs have been noticed to be very small in many cases and unequal in shape."

The scarcity of young Partridges is probably unprecedented; on some manors not a young bird is to be found, and it will take several good nesting seasons to bring up the stocks to their old numbers.

DISCUSSION.

Mr. EATON congratulated the Society on the progress shown by the observers in furnishing information for the reports just read, but stress should not be laid too much on the earliest appearance of the flowering or leafing of individual plants, which might possibly be in an abnormal condition. Regard should rather be paid to the general aspect of the species in question. As to the inclemency of the season just past, he had noticed primroses in full flower so late as the 1st of June, in the lanes on the northern outskirts of the New Forest, in Hampshire; close by, in the Forest, many of the oaks were only in bud, being as bare in appearance as at mid-winter. Quite recently he had gathered the young foliage and flowers of primroses in a wood near Addington, Kent, and was informed that the plants had been in flower all the summer. He fancied, from their remarks, that some of the observers were unaware that several of the resident British birds commenced their song in the autumn, and might be heard in mild weather all through the winter. Last week a thrush was singing at Bromley, though with uncertain note; and he had once heard a thrush singing joyously in a heavy snowstorm on Christmas day.

Mr. SCOTT said that it was very remarkable that the intense frosts of North-west America were well known not to kill the larvæ and pupæ of insects. He would therefore like to learn what was the condition of the pupæ, as their tissues were not frozen like those of plants.

Rev. T. A. PRESTON stated that the observer at Isleworth had collected a number of the larvæ of insects during the severe frost of last winter, and after being brought into a warm room and thawed they showed signs of life.

Mr. LECKY thought that worms were driven out of their holes by the wet and then drowned. With regard to the flowering of plants, he mentioned that he had observed an almond tree in Birdcage Walk in bloom last year (1878) on Feb. 23rd, while it did not come into bloom this year (1879) until April 23rd. There

* The nesting distribution of this species in Great Britain is very peculiar. Professor Newton, in his New Edition (4th) of "Yarrell's British Birds," Vol. I., page 554, says,—"A line drawn across England from the Start Point, slightly curving to round the Derbyshire Hills, and ending at the mouth of the Tees, will, it is believed, mark off the habitual breeding-range of this species in the United Kingdom; for southward or eastward of such a line it never, or only occasionally, breeds; while to the westward or northward its nest may be looked for in any place suited to its predilections."

should be standard trees, so that the observer could note when they came into bloom and compare them with others.

Mr. C. HARDING inquired if it were possible to compare each year's observations with an average of a number of years?

Mr. WHIPPLE thought that it would be desirable to give the common as well as the Latin names of the insects.

Mr. BALDWIN LATHAM said that during the year he had been engaged in inspecting various sewage farms throughout the country, as one of the Judges for the Royal Agricultural Society, and he had found that the time of cutting the rye-grass crop was, on an average, one month later this year than in previous years. There had been, however, a rapid growth of root-crops during the months of July, August, and September. It was a general complaint throughout the country that slugs had been very numerous, and had done much mischief; in many places the caterpillars had completely stripped gooseberry bushes, and in some places the currant bushes. With regard to the old adage about the oak and the ash, he had found this year that in some places they came out together, but taking the country through, the ash was considerably later than the oak, and in the North of England and some of the Midland Counties, many ash trees had been killed by the protracted winter.

Mr. SCOTT wished to know whether Mr. Latham had noticed any difference between the state of the crops in Yorkshire and in the Thames Valley, as in the latter district the rainfall had been much more excessive than in the former. It was remarkable that while the potato crops in Wales were almost destroyed early in August by disease, those in Ireland showed very little signs of it at the same period.

Mr. BALDWIN LATHAM, in reply to Mr. Scott, said that in 1877 the crops were bad, in 1878 they were worse, and in 1879 they were simply ruinous. Potatoes were grown on many sewage farms. At Aldershot, where the soil was sandy and favourable, the heavy rain of May 28th and the subsequent wet summer destroyed large tracts of potatoes. It was remarkable that there was but little disease in the potatoes on the sewage farms during the past wet season, or indeed at any period. This was perhaps due to some property of the sewage that killed the fungoid growth which caused the potato disease. With regard to cereal crops, he had observed this year that there was a want of filling in the lower portion of the ear in the case of wheat, oats, and barley, and in some cases of barley on heavy land the ears were devoid of grain. This state of things would naturally affect the yield; and moreover, in the absence of sunshine, in a wet season like the past, the quality of the grain was as a rule very inferior, which again affected the price.

Rev. T. A. PRESTON in reply said he was not aware that any experiments had been performed for the purpose of determining whether the fluids of insects had been frozen. The larvæ were in some cases stiff when brought into a warm room, but afterwards revived. Mr. Lecky had observed that the worms were probably drowned, with which the Fellows present seemed to concur; and he (Mr. Preston) also thought that this was the case, as the temperature of the earth had never fallen below 32°. It would be very difficult to select standard trees for reference. It was not unfrequently the case that a particular tree was notoriously in advance of all others of the same species in the same locality, *e.g.* a Horse Chestnut flowering a week or more before others near; also the conditions surrounding them were continually altering, even pruning would make a difference. But it was desirable to record the times of leafing and flowering of some at least of the trees and shrubs in cultivation, without selecting such exceptional trees as those alluded to. He quite agreed with the remark that it was desirable to have averages; this would be done as soon as there was a sufficient number of years to work upon. But it would not be expedient to insert the common as well as the Latin names of insects and plants, as they were not known by the same name all over the country. Under any circumstances, the scientific names must be inserted. At Marlborough, it had been observed this year that although potatoes were good when first lifted, in the course of a couple of days they had become greatly diseased.

Notes on the Meteorology of Zanzibar, East Africa. By JOHN ROBB, M.D., F.M.S., Surgeon Indian Army.

[Read November 19th, 1879.]

IN offering a few remarks on the meteorological observations made at Zanzibar during 5 consecutive years, it may be well at the outset to state briefly the geographical position of the island and its general formation.

The island of Zanzibar is situated off the east coast of Africa, about midway between Aden and Natal (Durban), at a distance of 1,700 miles from each of those stations, and is about 2,400 miles in a direct line south-west from Bombay. The island stretches in a direction from NNW to SSE, between south latitudes 5° 43′ 0″ and 6° 28′ 35″ and between east longitudes 39° 8′ 30″ and 39° 14′ 20″, its extreme length being about 52½ English miles. Its breadth varies considerably, owing to an irregularly broken coast line, but its greatest uninterrupted breadth may be put down at 27 English miles. Zanzibar Channel, between the island and the coast of the mainland of Africa, varies in width from 25 to 30 miles. The island has never, I think, been surveyed, but it is estimated to cover an area of 400,000 acres. It is more than twice the size of Malta, and rather less than half the size of Cyprus. According to some recent measurements the greatest elevation of its surface is 440 feet, and this height is reached a short distance north-east of the town on the hilly ridge that traverses the island interruptedly in its long axis, only a few miles distant from its west coast.

Dr. Christie describes the island as of coralline formation "erected on a base of stratified sandstone. . . . The madrepore structure is evidently based upon the summits of an abrupt and sharp rising submarine range, which of course must have been under the ocean level at some remote period. By the action of the gradually subsiding waters, a coralline conglomerate has been formed. On the southern and eastern parts of the island the deposit is more scanty, merely filling up the interstices of the coral rag, leaving exposed the bare summits, and making travelling, except by foot, exceedingly difficult. Where sufficient deposits have been left, the soil is fertile and the crops early, the porous understructure carrying off superfluous rains, but still retaining moisture and heat." The rich and productive section of the island is that occupying chiefly the western tract in its gently undulating slopes from the central ridge to the sea level. This is the leeward aspect, and it is in this direction that all madrepore islands are said to grow, while it is well protected from the long continued force of the SW monsoon. A few short streams intersect this fertile tract and discharge themselves into the sea, forming at their mouths, with the reflux of the tide, dense mangrove swamps, where the land is low and level. The eastern slope is in some parts fertile and populous; though generally, towards its southern limits, it is a waste and barren district, owing to its prolonged exposure to the desolating influence of the SW monsoon. Yet, from all accounts of natives, this is the healthy division of the island.

Near the middle of the west coast of the island is Râs Shangâni, a triangular spit of land on which is built the town of Zanzibar. It is in 6° 9′ 40″ S lat. and 39° 14′ 20″ E long., and at this point the observations were made, the results of which are given in the accompanying tables. These results are from the uninterrupted daily readings of various instruments for the five years 1874 to 1878; but in one or two particulars they differ so much from the observations already published for Zanzibar, that a few remarks in explanation seem to be called for. I am not acquainted with any recent records by foreign travellers or residents, and I cannot find out if Dr. Christie has published separately any observations besides those given in Chap. I. of his interesting book on the "Cholera Epidemics in East Africa." According to Burton, an "Eurasian apothecary, in charge of the Consulate, filled up in a rude way, during 9 months, a weather book with observations of the barometer, of two thermometers, attached and unattached, of dry and wet bulbs, of evaporation and of rainfall." And he continues, "In the Journal of the Royal Geographical Society,* Colonel Sykes published a record kept during 11 months in 1850, of the indications of several meteorological instruments at Zanzibar, unhappily without those of pressure." Then, once more, Captain Burton gives the results deduced from his own observations during a period of 9 months (1853-54), in his "Zanzibar," Vol. II., Appendix A. pp. 427-428. There does not, however, seem to be the record of any single complete year,—a circumstance no doubt due to the fact that many of those who have hitherto made observations, were engaged in travel and exploration, and had no fixed residence for any length of time.

From the accompanying series of observations, a fair average estimate may be made of the meteorological influences at work in determining the climate of Zanzibar. It has not been possible to give more than the general direction of the wind; and the amount of cloud and of evaporation has not been recorded.

The late Dr. Parkes says:—"For physicians the amount of evaporation is a very important point, not merely as influencing the moisture of the air abstractedly, but as affecting the evaporation from the skin and lungs;" but he remarks that "it is not easy to determine it experimentally, and no instrument is issued by the Army Medical Department." In a temperate climate like that of Europe, with a mean temperature of 52½°, the annual evaporation is considered equal to a layer of water 37 ins. thick, but within the tropics it varies from 80 to 100 ins. Such excessive evaporation does not go on unchecked in the island of Zanzibar, especially in its western half, for there is a rank luxuriance of protecting and absorbing vegetation, requiring for its nourishment all the moisture that can be derived from a rainfall that is at no time great.

The average annual rainfall of 5 years is rather more than 61 ins., or only about double the average yearly fall in England. Hardly any other element of climate is of more importance to Zanzibar than the rainfall. To raise and

* Vol. XXIII., p. 101.

carry to maturity the food crops of the island, the rainfall must not be excessive, nor must it come in sudden deluges. These would result in damage to crops already standing, and in more general destruction by washing away the thin coating of soil which is nowhere too abundant or rich. Looking at the recorded rainfalls of former years—85 to 167 ins.—as stated by Burton and Christie, and comparing them with the tabulated results of the last 5 years given in the Appendix, it is evident that the rainfall has greatly decreased. Meteorologists recognise an intimate connection between the presence of trees and rainfall, so much so, that the rapid progress of tree-planting in the treeless tracts of the north-west of the United States of America at the present time, suggests that climatic changes of an advantageous nature will be recorded by the next generation. In this light, it is perhaps possible to believe that the diminution of the rainfall of recent years at Zanzibar, is in a measure due to the great destruction of trees over the whole island by the cyclone of the 15th of April, 1872. The slightly elevated portion of the centre of the island would be likely to show a heavier rainfall than that registered at the point on which the town stands; but it is assumed that the excessive falls already referred to were from observations also made in the town. The average number of rainy days is 121, one-third of the year, ranging from 101 to 139 during the period recorded. Only once during the 5 years has the rainfall of 24 hours reached 4·74 ins., and that was in December, 1877. Zanzibar has its double seasons of unequal duration, which, though best marked out by the prevailing winds, are less exactly determined by the so-called Greater and Lesser Rains. The advent of the rainy season corresponds with the sun's passing the zenith of Zanzibar in its northern and southern declinations—that is, on March 4th, and October 9th. The Greater Rains fall in March, April, and May, with their maximum in April, showing an average in 5 years of 14·84 ins. for that month; the Lesser Rains are from mid-October to the end of the year, November and December giving an average respectively of 7·39 ins. and 8·06 ins. The driest month is September, with an average rainfall of 1·86 in. No month is rainless.

The monsoon winds follow each other at pretty constant intervals, though they vary somewhat from year to year in strength and duration. Generally southerly winds blow more or less steadily from the beginning of May till October. The heavy rains of this monsoon reach Bombay about the end of June. From mid-December till about mid-March NE winds blow steadily, though during a shorter period and with a less maximum of force than the SW monsoon. Variable winds and calms characterise the intervals between the monsoons, and it is during this double season, locally known as *Tanga Mbili*, or "The Two Sails," that the most active trade is carried on between Zanzibar and the coast of the mainland, for then it is possible for native craft to navigate for a limited distance north and south of Zanzibar. While this is so for local traffic, the periodic monsoons regulate the movements of the seaborne trade with ports more remote, such as in India, the Persian gulf, Arabia, and the Red Sea, in a northerly course, and in Madagascar, the Comoro Islands, and the Portuguese possessions in East Africa in a southerly direction.

It is in this connection that these periodic winds have the principal share in the distribution of epidemic disease,—a connection traced by Christie in his work already referred to.

The mean temperature of 5 years is 80°·3, and the average yearly range, from highest maximum to lowest minimum, is 17°·5. The hottest months of the year are February and March, with a mean temperature of 82°·9 and 83°·2 respectively; the cool months are July and August, averaging 77°·2 and 77°·4. This gives a small amplitude of the yearly fluctuation—rather less than 6°—and to this limited range of temperature is largely due the debilitating nature of the climate of Zanzibar, particularly as affecting the nervous system. The heat is constant and moist, and even gentle exercise is usually attended with excessive perspiration. The constant evaporation from the water surrounding the island tends to lower the temperature and to charge the air with moisture. The maximum daily temperature is reached between 2 p.m. and 3 p.m. The minimum of the day takes place between 10 p.m. and 4 a.m.; and it is during these treacherous hours, when heavy dews fall, that the body injudiciously exposed in sleep to a falling temperature is most liable to contract the "chills" which, in tropical climates, lay the foundation of bad health, and cause death more frequently than exposure during the day-time to direct solar heat. The mean of the maximum temperature of solar radiation (black bulb thermometer *in vacuo*) for 4 years is 162°·1; the greatest maximum reached being 187°·5 in February, 1877, while the mean temperatures of evaporation and of the dew point are respectively 74°·7 and 71°·9, falling 2° to 3° below these points during the months of July and August.

The humidity has already been mentioned as considerable and constant. The mean percentage of saturation is 80, and this large proportion of atmospheric moisture greatly adds to the exhausting effects of the heat by retarding evaporation from the surface of the body. It is for this reason, or rather on this account, that high authority asserts that those "who take exercise in the open air, even in the hot parts of the day 'are in the highest state of health,' the action of the lungs and heart being increased, and so in a degree, counteracting the effects of climate." But the effects of humidity are much influenced by the prevailing temperature, and Dr. Parkes affirms that "warmth and great humidity are borne on the whole more easily than cold and great humidity."

The range of the barometer at Zanzibar is 0·186 in. when corrected and reduced. The mean pressure of 4 years is 29·935 ins., which is almost exactly that indicated by the barometer at the Equator, or 29·948 ins. The temperature and pressure charts show their relations to each other throughout the year,—a rising thermometer corresponding with a falling barometer. Electric phenomena are most frequent when the barometer is depressed, and thunderstorms take place from November to March, during the prevalence of the north-east monsoon.

Generally, the climate of Zanzibar is not such as would be expected so near the equator. It has been greatly abused, but much of the bad character commonly ascribed to it is due to the shortcomings of individuals, who,

unwilling to confess their indiscretions of life, think climate a fit and proper scape-goat whereupon to lay the results of their own irregularities. That the climate of Zanzibar is debilitating is not to be denied; and after a few years' residence under ordinary conditions of existence, a change to a bracing climate is necessary to re-establish health for a further term of service. As is seen, the temperature is comparatively even throughout the year, and from year to year; not in itself excessive, but, combined with humidity, sufficiently high to exert a depressing effect upon the nervous system generally. These remarks apply to the town chiefly; the interior of the island, where vegetation is rank, and the malarial poison constantly active, is not so healthy; but to what degree health becomes endangered has not yet been tested, since, in the case of Europeans at least, residence in those parts has been only temporary, and after a rough-and-ready fashion. The coast of the mainland of Africa is undoubtedly prejudicial to health; and both Europeans and our British Indian subjects, who have occasion to pass any considerable time there, suffer severely from fever of a bad remittent type and from dysentery. The dweller on the coast is readily recognised by his sallow complexion and care-worn features—the first striking characteristics of a constitution poisoned with malaria. To such, the simple change to healthier Zanzibar is highly beneficial; but nothing short of a long sea voyage or a journey home is altogether sufficient to counteract the disastrous effects of this malarious poisoning. All seasons of the year on the coast are bad, but some are better than others, and travellers passing into the interior are usually recommended to get clear of the coast before the heavy rains begin to fall. February and March are the favourable months for making a start. Yet it must be remembered that the seeds of disease are not unfrequently sown by even a short occupation of the coast, whether from choice or from the necessary time required in building up a caravan, and death overtakes the traveller when he has advanced many marches into the more healthy interior. To avoid as much as possible encountering any such risk, it is well for travellers always to march quickly across the unhealthy belt of coast, and to locate their camps in the higher and drier districts beyond; and thus, though duty may require their presence at the coast, they may wisely contrive to pass the treacherous hours of the night where possible risk of contracting disease is reduced to an almost controllable minimum. Regarding the town of Zanzibar itself, stringent sanitary rules are much needed. Once in force, they will greatly add to the comfort and well-being of the foreign resident; and in greater measure, according as the hygienic conditions of his individual life are such as life in all tropical climates demands. The mercantile houses long established in Zanzibar think fit to provide for the relief of their agents and clerks every 3 years, in ordinary circumstances; and this term of continuous residence may be doubled, without apparent injury to health, provided always that no element of debility already exists, which a tropical life might be expected to bring into activity. General improvements now in progress in the opening out of streets and rebuilding of houses will materially add to the dignity of the capital, to say nothing of the higher benefits that will certainly accrue to the public health of the place.

Results of Meteorological Observations taken at Zanzibar, East Africa.

Months.	Mean Pressure.	Temperature. In the Shade. Extremes. Max.	Extremes. Min.	Extremes. Range.	Means. Max.	Means. Min.	Means. Range.	Means. Mean.	In the Sun. Max.	In the Sun. Mean.	Humidity.	Rain. Amount.	Rain. Greatest Fall.	Rain. No. of Days.	Prevailing Winds and Remarks.
1874.			°			°		°				Ins.	Ins.		
January	..	..	75.8	..	..	77.4	..	82.0	..	..	83	.34	.26	6	1. The max. readings were affected by a faulty position of the thermometer.
February	..	..	71.8	..	..	78.2	..	82.5	..	..	81	3.34	2.70	7	2. No instruments for recording pressure and solar radiation.
March ..	..	..	72.8	..	..	78.6	..	83.6	..	..	81	6.10	2.45	10	
April	..	..	71.3	..	..	76.2	..	82.2	..	..	88	15.18	3.74	16	
May	..	..	71.3	..	..	74.4	..	80.0	..	..	79	4.90	2.04	11	
June	..	..	71.8	..	..	73.6	..	78.9	..	..	82	1.61	.99	4	
July	..	..	69.8	..	..	72.1	..	77.3	..	..	80	1.09	.78	4	
August ..	..	..	68.8	..	..	71.6	..	77.0	..	..	83	.67	.23	9	
September	..	..	70.8	..	..	72.1	..	77.9	..	..	84	1.22	.68	12	
October ..	..	..	71.3	..	..	73.0	..	79.3	..	..	..	2.14	.70	9	
November	..	..	71.8	..	..	74.8	..	80.5	..	..	73	6.00	.92	17	
December	..	..	73.8	..	..	76.4	..	82.2	..	..	..	3.52	.90	15	
Year ..	..	..	68.8	..	..	74.9	..	80.3	..	..	..	46.11	3.74	120	
1875.	Ins.	°	°	°	°	°	°	°	°	°		Ins.	Ins.		
January	..	..	73.3	..	..	76.3	..	81.1	..	..	..	3.56	1.83	9	N. The above notes apply to the early months of this year.
February	..	..	74.8	..	..	77.1	..	81.4	..	..	..	3.89	1.25	11	NE; S.
March ..	..	..	72.8	..	..	74.4	..	82.3	..	..	..	3.79	.69	13	S; SW.
April	..	..	71.3	..	..	76.5	..	81.1	176.0	165.2	78	18.75	3.57	17	SW.
May	..	86.2	72.3	13.9	83.9	74.7	9.2	79.5	162.5	156.5	81	9.46	2.52	11	SW.
June	29.997	84.7	72.5	12.2	82.6	75.9	6.7	78.6	155.0	154.7	75	1.15	.46	6	SW.
July	30.031	82.2	71.5	10.7	80.3	73.9	6.4	76.8	155.5	155.2	79	4.93	1.95	8	SW.
August ..	30.031	83.4	71.8	11.6	80.9	73.5	7.4	76.7	157.5	153.0	75	1.90	1.15	8	SW light.
September	29.997	85.4	73.3	12.1	82.9	74.6	8.3	78.2	170.0	163.7	72	0.32	.16	3	S light.
October ..	.961	86.9	73.8	13.1	83.2	75.8	7.4	78.8	166.0	164.5	70	8.05	2.52	9	Variable; calms; S; NW.
November	.906	86.7	74.8	11.9	84.4	77.5	6.9	80.9	177.5	174.2	64	5.50	1.42	11	Variable; calms.
December	29.844	87.2	76.3	10.9	84.8	78.7	6.1	81.9	176.0	171.8	69	6.95	1.79	12	Steady light N.
Year ..	..	..	71.3	..	..	75.7	..	79.8	..	..	..	68.25	3.57	118	

Results of Meteorological Observations taken at Zanzibar, East Africa.

Months.	Mean Pressure.	Temperature. In the Shade. Extremes. Max.	Min.	Range.	Means. Max.	Min.	Range.	Mean.	In the Sun. Max.	Mean.	Humidity.	Rain. Amount.	Greatest Fall.	No. of Days.	Prevailing Winds and Remarks.
1876.	Ins.	°	°	°	°	°	°	°	°	°		Ins.	Ins.		
January	29·827	85·9	76·3	9·6	84·9	79·4	5·5	82·1	173·5	168·3	70	3·57	2·08	8	N.
February	·827	87·6	75·3	12·3	85·1	79·3	5·8	82·4	169·0	166·6	68	2·47	1·31	6	N.
March ..	·858	88·6	76·0	12·6	85·1	78·9	6·2	81·8	174·0	169·0	76	12·72	2·47	15	N; SW; SSW; S.
April	·872	85·7	74·3	11·4	82·7	77·3	5·4	79·9	179·5	166·6	87	13·81	2·13	21	SW; SSW; SSE.
May	29·965	84·7	72·3	12·4	81·6	75·8	5·8	79·0	163·0	158·6	85	9·46	3·77	18	S; SW.
June	30·041	82·2	71·3	10·9	80·3	74·3	6·0	77·3	154·0	150·7	82	2·02	·79	6	SW; S; SSE.
July	·063	82·2	71·5	10·7	80·3	73·7	6·6	76·5	153·0	151·8	80	2·20	·98	6	SW; SSW; variable.
August ..	·032	82·2	71·8	10·4	80·3	73·5	6·8	76·8	159·0	155·6	82	4·47	3·22	7	SW; S; Easting.
September	30·020	82·9	72·3	10·6	81·1	73·6	7·5	77·2	164·0	159·7	81	3·33	1·23	9	S; E; variable; N.
October ..	29·973	86·9	73·0	13·9	83·2	75·6	7·6	79·4	164·0	162·7	77	·13	·10	2	SE; light, variable.
November	·899	87·6	74·0	13·6	84·5	77·8	6·7	81·4	172·5	171·0	84	7·37	4·63	11	S; SE into N.
December	29·897	87·3	74·8	12·5	85·0	78·4	6·6	82·2	171·0	170·2	82	9·33	2·81	14	N; NE.
Year ..	29·940	88·6	71·3	17·3	82·8	76·5	6·3	79·7	179·5	162·6	79·5	70·88	4·63	123	
1877.	Ins.	°	°	°	°	°	°	°	°	°		Ins.	Ins.		
January	29·875	87·8	78·8	9·0	86·4	80·0	6·4	83·6	179·0	172·3	81	1·94	1·05	4	NE; E.
February	·875	88·6	78·8	9·8	86·5	80·0	6·5	83·6	187·5	172·8	80	·24	·16	4	N; NE.
March ..	·853	87·8	77·5	11·3	86·0	80·1	5·9	83·4	170·0	166·8	80	4·22	1·00	13	N; W; E; variable.
April	·869	87·6	76·0	11·6	84·4	78·9	5·5	81·7	171·0	164·7	82	10·61	2·77	16	SW; S.
May	29·961	86·9	74·5	12·4	83·7	77·2	6·5	80·3	160·0	157·0	82	5·01	1·37	15	SW; S.
June	30·066	84·4	72·8	11·6	82·2	76·1	6·1	78·9	154·5	152·7	81	3·07	1·63	6	SW; S; Easting in afternoon.
July	·047	83·4	72·5	10·9	81·8	74·8	7·0	78·0	152·5	150·2	83	2·09	·91	10	S to SE; N.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	S to SE; Easting.

Months.	Mean Pressure.	In the Shade.							In the Sun.		Humidity.	Amount.	Greatest Fall.	No. of Days.	Prevailing Winds and Remarks.
		Extremes.			Means.										
		Max.	Min.	Range.	Max.	Min.	Range.	Mean.	Max.	Mean.					
1878.	Ins.	°	°	°	°	°	°	°	°	°		Ins.	Ins.		
January	29·851	88·8	78·5	10·3	86·4	79·9	6·5	84·3	172·0	165·3	82	2·26	·81	8	NE steady till 22nd; S; and a week of calms.
February	·869	89·1	75·8	13·3	86·8	80·3	6·5	84·8	167·0	164·7	83	5·05	1·11	11	NE till 22nd, then Southerly and calms.
March ..	·864	90·6	76·8	13·8	87·1	80·6	6·5	84·7	170·0	167·8	83	2·79	·69	9	NNE until mid-month; variable through E into S and SW. Thunder.
April	·880	87·8	76·3	11·5	85·0	78·8	6·2	82·5	167·0	159·5	81	15·87	3·58	14	Southerly in W and E; very high tide on 18th.
May	29·958	87·6	72·0	15·6	84·1	77·6	6·5	81·5	158·5	156·1	82	5·97	3·50	5	WSW through S into SSE; steady in S.
June	30·015	85·4	72·5	12·9	82·3	75·5	6·8	79·4	160·5	154·0	82	2·61	·96	7	SW through S into SSE.
July	·007	83·9	72·5	11·4	81·6	74·5	7·1	77·5	156·5	149·8	81	1·27	·60	4	WSW through S in SSE; calms and light N winds at end of month.
August ..	·014	84·9	74·3	10·6	81·8	75·2	6·6	78·1	162·0	156·2	84	1·51	·55	8	W through S in E variable; calms; fresh N on 4 days.
September	30·019	84·7	71·0	13·7	81·8	74·5	7·3	77·6	159·0	154·6	83	2·70	·72	9	Variable W into E through S; 12 days in N and E; 12 mornings calm.
October ..	29·948	85·9	73·5	12·4	83·3	75·6	7·7	79·0	166·5	161·7	83	2·52	1·07	8	Variable through S & E to N; 16 days in N variable; 25 morns. calm. Thun.
November	·933	87·2	75·3	11·9	84·5	77·7	6·8	80·9	168·0	164·6	84	4·95	1·56	11	17 days N variable; 16 calm morns. SE to N through E variable. Thunder.
December	29·873	86·9	75·5	11·4	84·5	78·5	6·0	81·8	174·0	168·2	85	8·70	3·62	7	Steady N through NE into E; 9 calm mornings; 3 days W. & S. Thunder.
Year ..	29·936	90·6	71·0	19·6	84·1	77·4	6·7	81·0	174·0	160·2	82·8	56·20	3·62	101	
Monthly Results for the Five Years, 1874-1878.															
	Ins.	°	°	°	°	°	°	°	°	°		Ins.	Ins.		
January	29·851	88·8	73·3	15·5	85·9	78·6	7·3	82·6	179·0	168·6	79	2·33	2·08	7	NE; E; calms; S.
February	·853	89·1	71·8	17·3	86·1	79·0	7·1	82·9	187·5	168·0	78	3·00	2·70	8	NE; E in afternoon.
March ..	·858	90·6	72·8	17·8	86·1	78·5	7·6	83·2	174·0	167·9	80	5·92	2·47	12	N; NE; variable W.
April	·873	87·8	71·3	16·5	84·0	77·5	6·5	81·5	179·5	164·0	83	14·84	3·74	17	Southerly in W and E.
May	29·961	87·6	71·3	16·3	83·3	75·9	7·4	80·0	163·0	157·0	82	6·96	3·77	12	WSW; SSE; S.
June	30·029	85·4	71·3	14·1	81·9	75·1	6·8	78·6	160·5	153·0	80	2·09	1·63	6	SW into SSE; E.
July	·037	83·9	69·8	14·1	81·0	73·8	7·2	77·2	156·5	151·7	81	2·32	1·95	6	WSW; S; SSE; N.
August ..	·030	84·9	68·8	16·1	81·3	73·8	7·5	77·4	162·0	155·1	82	2·49	3·22	8	W; S; E; variable, calms.
September	30·002	85·7	70·8	14·9	82·4	74·2	8·2	78·1	170·0	158·8	81	1·86	1·23	9	W; E; S; calms; Northerly.
October ..	29·956	86·9	71·3	15·6	83·5	75·3	8·2	79·4	167·0	162·9	79	3·75	2·52	9	S; E; N; calms, variable.
November	·904	87·6	71·8	15·8	84·3	77·1	7·2	80·9	177·5	168·6	78	7·39	4·63	14	SE; E; N; calms, variable.
December	29·867	87·3	73·8	13·5	84·8	78·1	6·7	82·2	176·0	169·2	80	8·06	4·74	13	NE; N; steady, calm mornings.
Year ..	29·935	90·6	68·8	21·8	83·7	76·4	7·3	80·3	187·5	162·1	80·3	61·01	4·74	121	

TABLE showing the number of days on which were recorded thunder, lightning only, or thunder only, 1875-1878.*

Months.	Lightning and thunder.				Lightning seen; thunder not heard.				Thunder heard; lightning not seen.			
	1875.	1876.	1877.	1878.	1875.	1876.	1877.	1878.	1875.	1876.	1877.	1878.
January	?	5	1	1	?	2	2	3	?	2	1	3
February	?	3	2	6	?	3	..	..	?	3	3	3
March	?	8	7	3	?	..	..	..	?	7	8	8
April	2	1	3	1	..	..	..	..	6	5	2	2
May	1	..	..	1	..	..	..	1	1	..	..	..
June	..	..	..	..	..	..	..	..	..	..	..	..
July	..	..	..	..	..	..	..	..	..	..	..	..
August	..	..	..	..	..	..	..	..	..	..	..	..
September	..	..	..	..	..	..	..	..	..	1	..	..
October	..	..	1	3	..	..	..	..	1	1	..	..
November	1	1	2	3	..	.	..	..	3	5	3	3
December	5	6	5	8	..	1	1	1	3	6	2	3

* This Table has been prepared because it has been said that thunder is very seldom heard at Zanzibar.

REMARKS ON THE METEOROLOGICAL OBSERVATIONS.

The Tables submitted herewith are the result of daily recorded readings of various instruments for 5 consecutive years,—1874 to 1878 inclusive.

Amongst former observations which have been published, and to which I have had access, there does not seem to be the record of any one complete year, a circumstance due no doubt to the fact that those observations had been made by persons engaged in travel and exploration, with no fixed residence and always more or less on the move.

The instruments employed were all originally obtained from the Meteorological Office for the use of Lieut. Cameron's Expedition. They all possessed Kew Certificates.

The readings of all the Instruments have been corrected for index error, and the barometric pressure has been corrected and reduced.

The barometer is a marine one (Kew pattern); the rain-gauge is of Glaisher's pattern, and has been examined at sunset daily; the solar maximum thermometer is *in vacuo* with blackened bulb, and has been observed once a week; the other instruments need no description: at least 3 observations have been made daily, and oftener when possible.

The positions of the instruments arise from absolute necessity. They occupy the best and safest places that can be had for them, and, except in their height from the ground, they enjoy all the conditions required for accurate description. The thermometers are 27 ft., the solar maximum thermometer 47 ft., and the rain gauge 44 ft. above mean sea level.

Some instruments were wanting for a while, as shown on the records, but there are still 3½ years complete.

It has not been possible to give more than the general direction of the wind, as judged by the flags on the various flagstaffs, all of which rise high enough to be free from eddies. The amount of cloud and of evaporation has not been recorded. The dew point temperature, and the percentage of relative humidity, have been worked out by using Mr. Glaisher's factors.

On a New Form of Hygrometer. By George Dines, F.M.S.

[Read December 17th, 1879.]

The Hygrometer which now bears my name, was first described at the Brighton Meeting of the British Association in 1872. Its main feature was a contrivance for passing water, of a lower temperature than the dew point, through a small vessel covered with glass. When the dew appeared upon the surface of the glass the flow of the water was stopped, and the temperature taken by means of a thermometer, the bulb of which was placed inside the small vessel, just under the surface of the glass.

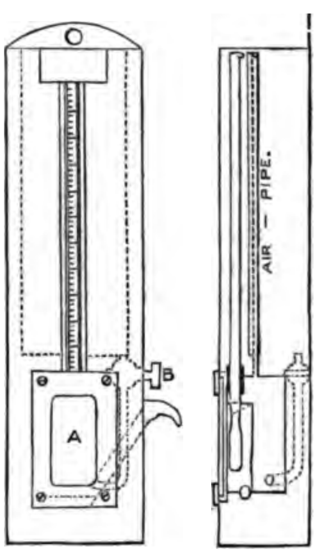
Since 1872 I have taken numerous observations with that Hygrometer without any definite object in view, and I have made more than one attempt to alter it, so that when the dew point could not be obtained by means of water, ether could be used. My earlier attempts, however, were not very successful; but during last summer, when wishing to make a systematic and continuous set of observations, I found that on some days well-water was not sufficiently cold to give the dew point, and as ice could only be procured from a distance, many observations were missed. This difficulty frequently occurred at a time when the wider range of the dry and wet bulb thermometers would have made such observations the more valuable, and my attention was therefore again turned to the subject. The result is, an instrument cheaper than the old one, equally simple, and adapted for the use of either ether or water.

The outside dimensions of the instrument, inclusive of the wood casing, are about 10 ins. in length, 8 ins. in breadth, and 2 ins. in depth. The upper part consists of a vessel of thin metal, 6 ins. long, 2½ ins. broad, and 1¼ in. deep. Beneath this and detached from it, but connected by a pipe, is a small chamber 2¼ ins. long, 1¼ in. deep from back to front, and ¾ in. broad upon the face, standing about ¼ in. more forward than the vessel above, and with a piece of thin black glass or metal in front. Inside this chamber, parallel to the front, is a division which separates it into two parts. This division does not extend quite to the top of the chamber, and is slightly turned over towards the front, so as to allow water to pass over it, and to induce the latter to flow more directly to the centre of the front of the chamber. The upper vessel is connected with the bottom and back part of this chamber by a small pipe, with a tap to it which is turned from the outside.

The front of the chamber has a pipe attached to the bottom, passing up-

ward in an inclined direction, and terminating at the outside in a small lip or spout. A thermometer, with the bulb inside and over the front of the chamber, passes through an indiarubber collar at the top of it, and is protected by a groove sunk in the face of the wooden case.

Elevation. Section.



DINES'S IMPROVED HYGROMETER.

The action of the instrument is as follows:—Water, of a lower temperature than the dew point, is placed in the upper vessel, and, on the tap being turned, flows into the back of the small chamber, and thence passing over the top of the middle division flows downward, cooling in its passage the thermometer and black glass, A, and eventually escapes by the small spout on the right side of the instrument. As soon as dew appears on the glass, the flow of the water is stopped by means of the tap, B, and the temperature is read off by the thermometer.

When ether is used, it is poured into the small spout, passes down the inclined pipe, and remains in the front part of the chamber. A piece of metal tube, ground so as to fit closely the inclined pipe, and with a an aspirator attached, is then inserted, and the dew point is ascertained in the same way as by Regnault's Hygrometer.

The size of this Hygrometer depends mainly upon the length required for the thermometer; but it may safely be made of less size than that mentioned in this paper. The wood casing may also be dispensed with, except in front, but owing to the rapid conducting power of the metal, and the condensation of moisture which takes place upon its surface, the casing adds greatly to the comfort of the observer while using the instrument.

I have again tried both glass and silver for the surface on which the dew is deposited, and still prefer black glass to any other substance; but whether glass or silver is used, there is one point to which much importance is attached, viz. that the centre should be made thinner than any other part. This arrangement causes the dew to appear upon that part first, though sometimes only momentarily, and thus a better definition is obtained than when it covers the entire surface.

Apart from its moderate cost, the most noticeable feature in this Hygrometer will be found in the use both of ether and water in the same instrument. Ether may be used at any time, and in any place, but it is both costly and troublesome, and therefore ought not to be resorted to except in cases of necessity. Water, on the contrary, when ice is not required, can hardly be said to cost anything; it can be used both with ease and pleasure, and its temperature as it passes through the small chamber, on the face of which

the dew is deposited, may be regulated with the utmost nicety, while at the same time the thermometer can be leisurely read off.

For some years I have been using the instrument designed in 1872, which is very similar to this, and am therefore in a position to state from long practice what are the best means of making such instruments fully available. Residents in the country have generally a well upon their premises, the water from which will give the dew point, both outside and inside the house, through a great part of the summer months, and in greenhouses, &c. for a much longer period. As the winter approaches the water from the bottom of a pond, or a large cistern, will often be found cold enough for the purpose; and when snow or ice is about, I have had a heap thrown up which has lasted for some days after the frost has disappeared.

Persons residing in large towns have not so many advantages for using the instrument without ether, but, on the other hand, ice can always be obtained by them at a moderate cost.

If a lower temperature than 32° is required, salt may be mixed with the snow or ice, but the latter alone is generally cold enough to give the dew-point indoors.

The Hygrometer of 1872 has the surface on which the dew is deposited horizontal, and when used is placed on a flat surface; the present instrument has the surface vertical, and is intended to be hung by a nail upon the thermometer stand; so far as my present observations extend, the horizontal position is preferable; the sky is then reflected on the glass, and the deposit of dew upon it shown more clearly than when the glass is vertical, and the dark earth seen in it as a back ground. This inconvenience is, however, in a great measure obviated by slightly inclining the glass from the vertical position when the instrument is in use. One further hint may be worth giving while touching upon this subject, which applies equally to both of these Hygrometers. It is this—try to get the water in the small chamber a little above the dew point temperature, and then allow colder water to trickle slowly through. If the cold water is allowed to flow into the small chamber with a rush, the glass will probably be covered with dew before the thermometer has time to give the temperature, or the water may be colder than is necessary, and the result will be an error of 2° or 3°.

The question may be asked, "Is this Hygrometer intended to supersede the use of the dry and wet bulb thermometers?" The answer decidedly is "No." The indications they give are so simply and easily followed, that it is difficult to imagine any instrument better suited for noting the changes which take place in the atmosphere; but the question to be determined is this—Is it possible, by knowing the temperature of the dry and wet bulb thermometers, to determine that of the dew point? It is here that doubt exists; and it is with the hope that the instrument now described may aid in the solution of this question that I have brought it under the notice of the Meteorological Society.

DISCUSSION.

Mr. WHIPPLE thought that the dew being deposited on a flat, black glass surface, was a great advantage, and that in this respect the instrument was better than Regnault's Hygrometer. He believed that iced water could be used with Regnault's instrument as well as ether. He should like to have a number of observations made with this instrument, as the dew point from eye observations differed somewhat from that found by calculation.

Mr. SYMONS said that a Regnault's Hygrometer with a flat surface had been exhibited before the Paris Academy by M. Alluard, the cost of which was about £6; but the price of Mr. Dines's instrument would be about £1. He thought that the grinding of the glass in the centre would have to be done with great care. He did not consider it desirable that this instrument should come into general use, as all observers would not be careful enough in using it, and personal errors would be very great; but for comparative purposes it would be extremely useful.

Mr. CASELLA said that the Dines Hygrometer was fast becoming well known and appreciated. It certainly gave an easier means of finding the dew point at any given spot than any other instrument he knew of, and it was as surprising as it was interesting to watch by it the rapid changes in the state of moisture in the air. In other instruments for this purpose, as the dry and wet bulb for instance, water only was used, whilst in Daniell's one great difficulty consisted in obtaining the indispensable ether of proper strength, especially in warm countries; and though these difficulties seemed to be considerably lessened in using Regnault's Hygrometer, yet ether was still necessary; whilst in the modifications of his instrument now introduced by Mr. Dines, either cooled water or ether might be used with equal facility, and the dew point shown in any part of the room or out of doors as often as desired. As to the question of dark glass or metal, Mr. Casella agreed with Mr. Dines in preferring the glass. He well remembered that in some interesting experiments on Regnault's Hygrometer at which he assisted, in connection with the late Dr W. A. Miller and Colonel Sykes, they insisted on a black glass bulb accompanying the instrument, as likely to be preferred to the silver one with which it was then usually made.

Mr. SCOTT believed the instrument would do only for careful observers. The Meteorological Council had recently requested a gentleman to undertake a comparison of various kinds of hygrometers, and this would shortly be carried out at the Cavendish Laboratory, Cambridge. He was sorry none of the speakers had mentioned Prof. Belli's arrangement for producing an artificial movement of the air round the wet bulb, or Prof. Schwackhofer's apparatus for determining the absolute amount of aqueous vapour in the air.

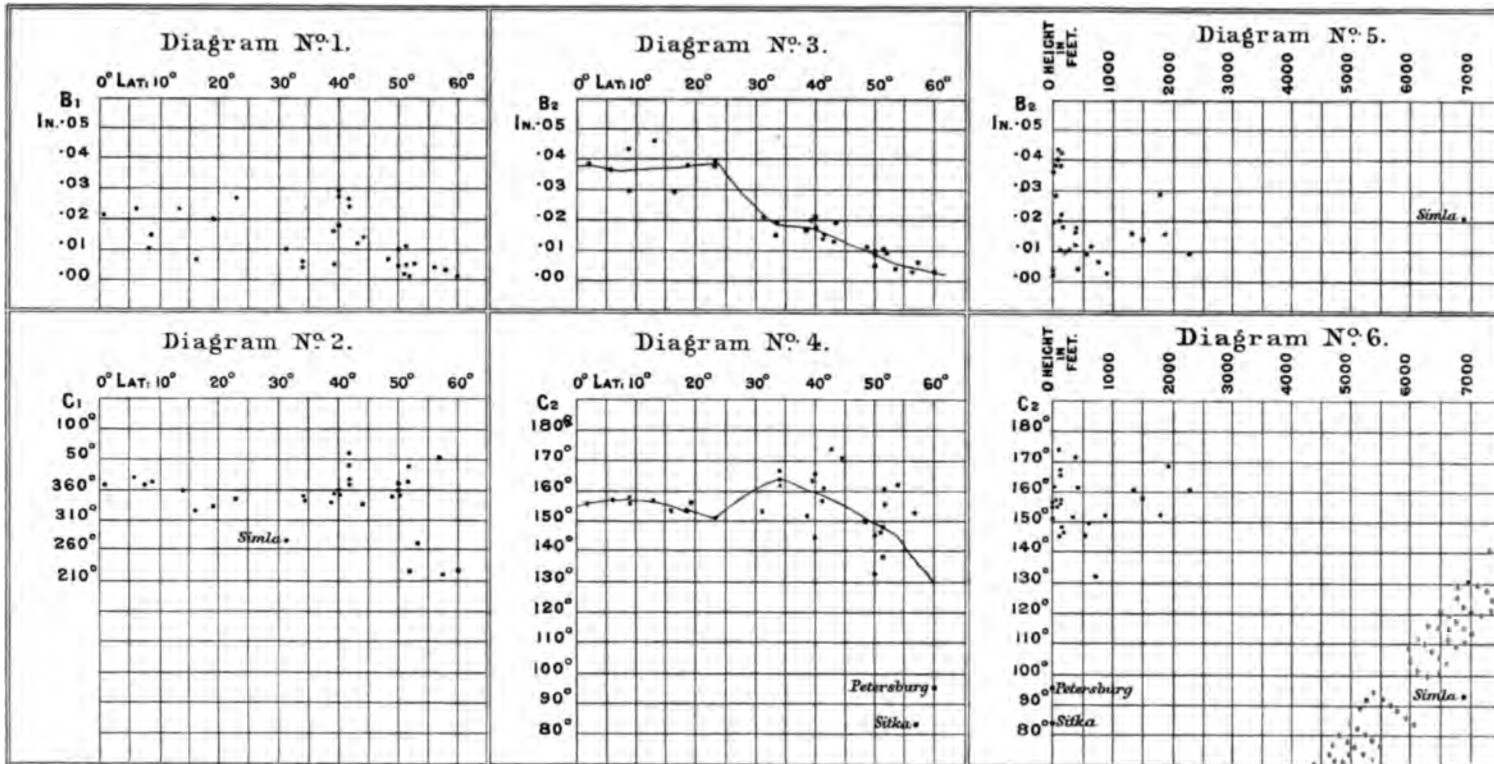
Mr. DINES in reply said he was not quite satisfied with one part of the hygrometer. He doubted if the joint between the glass and metal would stand permanently against ether. He should regret the loss of the bright black surface of the glass, but if metal could be found for the purpose it would be preferable. It might be soldered on to the other parts, almost detached from the wood; there would be less material to cool down, and nothing in the instrument likely to get out of order.

The Diurnal Range of Atmospheric Pressure. By RICHARD STRACHAN, F.M.S. (Plate II.)

[Read December 17th, 1879.]

IN the Quarterly Journal of the Meteorological Society, Vol. V. p. 41, the late Mr. J. Allan Broun, F.R.S., stated his belief that more facts were required before any hypothesis would be generally accepted as true and sufficient to account for the phenomenon of diurnal range of atmospheric pressure. As a contribution towards such an accumulation of facts, the

DIURNAL RANGE OF ATMOSPHERIC PRESSURE.



Malby & Sons.

accompanying table of co-efficients of diurnal atmospheric pressure is now submitted to the Society. These co-efficients have all been calculated from the original data by Mr. G. Harvey Simmonds, F.M.S., who has most kindly placed them at the author's disposal.

According to the nomenclature adopted by Mr. W. W. Rundell, F.M.S., these co-efficients are designated as follows :—B_1 and C_1 are respectively the semicircular components and angles; B_2 and C_2, the quadrantal components and angles; B_3 and C_3, the sextantal components and angles; and the superposition of their respective curves composes the curve of barometric diurnal range.

The chief of these co-efficients have been plotted on diagrams, numbered I. to VI. (Plate II.), in the manner now to be described :—

Diagrams I. and III. have for abscissæ the latitudes of the places of observation, and for ordinates the values of B_1 and B_2 respectively.

Diagrams II. and IV. have also latitudes for abscissæ, but the ordinates are values of C_1 and C_2 respectively.

Diagrams V. and VI. have the elevations of the places of observation above the sea for abscissæ, and the values of B_2, C_2 respectively, for the ordinates.

By means of these co-efficients, the equation

$$E = B_1 \sin (\theta + C_1) + B_2 \sin (2\theta + C_2) + B_3 \sin (3\theta + C_3)$$

gives the component of the barometric range at any time θ reckoned in degrees from midnight.

From diagram I. no direct relation can be traced between the semicircular component and the latitude; all that can apparently be noticed is that its value decreases rapidly as the latitude increases beyond 40°.

From diagram II. no direct relation can be traced between the values of the semicircular angle and the latitude. C_1 for Simla is abnormal, and doubtless due to elevation above the sea. Its values for Greenwich, St. Petersburg, and Sitka are also abnormal, but the causes are not obvious.

Diagram III. shows an evident relation between the quadrantal component and the latitude. In the tropics the effect of latitude is scarcely perceptible, but from latitude 23° to 60° the value of B_2 decreases at the rate of ·001 in. per 1° of latitude.

Diagram IV. can hardly be said to show any relation between the quadrantal angle and the latitude. The values of C_2 for Sitka and St. Petersburg are peculiar.

Diagram V. exhibits no relation between the quadrantal component and elevation above the sea.

Diagram VI. exhibits no relation between the quadrantal angle and elevation above the sea.

The sextantal constants C_3, B_3, are generally of inconsiderable importance, and are not discussed in this paper.

Mr. Rundell says:* "Speaking very roughly, the semi-circular com-

* Quarterly Journal, Vol. V. p. 18.

Co-efficients of the Diurnal Range of Atmospheric Pressure calculated by G. H. Symmonds, F.M.S.

Name of Place.	Latitude.	Longitude.	Height.	Period.	Years.	C_1.	B_1.	C_2.	B_2.	C_3.	B_3.
	° ′	° ′	Feet.			°	In.	°	In.	°	In.
Singapore	1 27 N	103 49 E	Few	1841 to 1845	5	10·3	·0210	156·0	·0387	63·3	·0015
Trevandrum	8 31 N	77 0 E	195	June 1837 to May 1842	5	20·3	·0154	158·2	·0424	23·1	·0013
Madras	13 4 N	80 14 E	22	1844 to 1850	7	358·9	·0234	157·6	·0432	360·0	·0007
Bombay	18 53 N	72 48 E	38	1846 to 1862	17	332·9	·0198	156·4	·0382	16·3	·0014
Calcutta	22 31 N	88 21 E	18	1855 to 1869	15	340·9	·0270	151·6	·0394	348·5	·0012
Simla	31 6 N	77 12 E	6,953	July 1841 to December 1846	5·5	275·7	·0100	138·7	·0210	338·3	·0015
Lisbon	38 43 N	9 8 E	335	January 1864 to November 1870	6·9	336·6	·0053	152·1	·0176	2·4	·0022
Pekin	39 57 N	116 29 E	101	1850 to 1855	6	0·8	·0295	144·8	·0217	346·0	·0026
Washington	38 54 N	77 3 W	103	1861 to 1869	9	355·6	·0168	163·8	·0201	262·9	·0024
Girard College	39 58 N	75 11 W	112	June 1840 to June 1845	5·1	356·6	·0183	165·8	·0179	12·1	·0018
Toronto	43 40 N	79 21 W	342	1841 to 1847	7	332·4	·0140	171·5	·0127	21·7	·0020
Tiflis (Awlaba)	41 42 N	44 50 E	1,501	January 1855 to April 1862	7·3	18·6	·0246	157·5	·0142	332·3	·0021
„ (Kuki)	41 43 N	..	1,343	May 1862 to December 1871	9·7	24·3	·0266	160·9	·0162	357·1	·0018
Vienna	48 13 N	16 23 E	650	1849 to 1856*	8	352·4	·0068	149·5	·0113	2·2	·0012
Cracow	50 4 N	19 58 E	712	1850 to 1856	7	17·5	·0050	132·5	·0066	346·4	·0016
Prague	50 5 N	14 25 E	351	1842 to 1868	27	1·5	·0100	145·1	·0086	11·8	·0011
Brussels	50 51 N	4 22 E	190	1842 to 1869	28	358·8	·0019	146·1	·0095	8·7	·0012
Greenwich	51 29 N	0 0	159	1841 to 1847	7	223·9	·0011	147·9	·0104	56·6	·0004
Oxford	51 46 N	1 15 W	212	1855 to 1870	16	42·7	·0046	156·1	·0096	3·3	·0013
Nertchinsk	51 18 N	119 30 E	2,230	1842 to 1845, 1848 to 1855, and 1856 to 1862	19	13·1	·0126	161·1	·0098	326·0	·0016
Barnaoul	53 20 N	83 37 E	400	1842 to 1845, 1850 to 1855, and 1856 to 1862	17	279·2	·0046	162·0	·0044	352·3	·0011
Catherinenburg	56 50 N	60 34 E	813	1842 to 1845, 1849 to 1855, and 1856 to 1862	18	55·4	·0036	152·8	·0035	302·7	·0003
Sitka	57 9 N	135 18 W	15	1843 to 1845, 1848, 1850 to 1854 and 1856	10	225·9	·0028	83·7	·0037	237·3	·0003
St. Petersburg	59 57 N	30 28 E	15	1841 to 1862	22	240·7	·0014	96·2	·0035	296·9	·0006
Batavia	6 11 S	106 50 E	24	1866 to 1872	7	23·6	·0239	157·3	·0369	11·8	·0016
Ascension	7 55 S	0 58 W	53	September 1863 to August 1865	2	17·4	·0106	156·5	·0279	296·6	·0004
St. Helena	15 57 S	5 41 W	1,764	1841 to 1846	6	324·1	·0071	153·4	·0293	78·0	·0014
Santiago de Chile	33 26 S	70 38 W	1,790	November 1849 to September 1852	2·9	343·8	·0065	167·2	·0157	195·0	·0014
Cape of Good Hope	33 56 S	18 29 E	Few	April 1841 to June 1846	5·2	347·8	·0047	162·0	·0192	11·8	·0014
Hobarton	42 52 S	147 27 E	105	1841 to 1847	7	47·5	·0123	174·1	·0197	17·6	·0018

* Only 7 months of April.

ponent may be said to vary, up to latitude 45°, as sin ⅔ latitude, and then to decrease somewhat irregularly in the higher latitudes. The quadrantal component may be roughly said to vary as $\cos^3$ latitude, and the sextantal component as $\cos^3 2$ latitude.* These differences seem enough to show that no simple function of the latitude is likely to express the sum of the three components." These conclusions seem to require confirmation.

Mr. Rundell noticed a remarkable difference in the mean quadrantal angles for Greenwich and Oxford. Its phases occur at Oxford, he says, about half-an-hour earlier than at Greenwich, but according to Mr. Simmonds only 16 or 17 minutes earlier. He also found the quadrantal component larger at Oxford than at Greenwich, and thinks that "The larger values for Oxford as compared with Greenwich are no doubt to a great extent due to those causes which distinguish the meteorology of inland stations from those which are near the coast." Mr. Simmonds, however, obtained the reverse result.

Mr. Rundell adds: "These causes of difference may probably be summed up as belonging to differences of temperature and difference of range of temperature, differences in relative humidity and in range and kind of vapour pressure, relative amount of cloud and sunshine, and the whole of these as modified by latitude and by prevalent winds."†

Mr. F. Chambers maintains the existence of a distinct diurnal variation of barometric pressure, due to convection currents of air arising from the expansion of the atmosphere over heated land, producing a fall of the barometer in the interior, and which, accumulating over the surrounding sea, produces there a rise of the mercurial column. He concludes that "nearly all the differences observable in the diurnal variations of the barometric pressure at different stations in the British Isles are explicable by the ordinary convection current theory, and that the problem of giving a complete explanation of the diurnal variation of the barometric pressure there is reduced to the explanation of the normal variation,"‡ which he believes will only be made by more attention being given to the development of the diurnal variations of the wind.

It ought not to be overlooked that Mr. Rundell has remarked that "the quadrantal angle varies so little that the equation of time becomes a considerable factor in its composition, and where the observations are regulated by the hours of mean time a correction should be made;" however, as regards the yearly values given in the present table this remark cannot apply, as in the course of the year the equation of time is cancelled.

Neither should the following assertion of Mr. Broun be passed unheeded: "It is found that the amplitude of the quadrantal oscillation diminishes in ascending as the pressure diminishes; or if r be the range of the oscillation at any height for which the pressure is p, $\frac{r}{p}$ = constant. This con-

* In the original paper $\cos^3 2$ lat. is an erratum. It should be $\sin^3 2$ lat. EDITOR.

† Quarterly Journal, Vol. V. p. 11.

‡ Ibid. Vol. V. p. 133.

stant is nearly the ratio of the centrifugal force to the force of gravity."* It would not lead to any satisfactory results to discuss this question with the small number of places at considerable elevation for which the table affords data.

In an interesting article in "Nature," for February 20th, 1879, Mr. Broun has shown from observations made at Makerstoun, Dublin, Greenwich, and Brussels, that the range of the coefficient B_2 diminishes as the latitude increases at the rate of ·00101 in. for each degree. So far the result deduced from Mr. Simmonds' data coincides with that deduced from Mr. Broun's. But it is added, "The exact agreement in the epochs of maxima and minima, and the regularity of the variation of range with latitude in the quadrantal oscillation, show that this oscillation obeys a general law." Now, the exact agreement of the epochs of maxima and minima is not borne out by the large number of results here brought together from all parts of the world, as an inspection of diagram IV. will show at a glance, so it can scarcely be said that the quadrantal oscillation obeys a general law. Nor can it be said that "the quadrantal oscillation of the atmospheric pressure is due to a cosmic cause independent of local influences," while so much discrepancy exists among the results generally, and especially with respect to Sitka, and St. Petersburg, for their epochs for the quadrantal period are widely different from those for the other stations.

The discussion of the constants B_1 and C_1 would apparently require a far larger number of stations than there are data for at present. Their amplitudes and epochs are known to vary with the seasons and with elevation above the sea. The elevated stations are insufficient in number and distribution to warrant any generalisations founded on elevation, and the question of the seasons is entirely excluded from the data under consideration; but it will be apparent from diagrams I. and III. that from latitude 40° to 60° the values of B_1 and B_2 are almost equal to each other. Sir John Herschel, "Meteorology," p. 163, says: "The diurnal oscillation of the barometer is a phenomenon which invariably makes its appearance in every part of the world where the alternation of day and night exists;" and, he adds, within the Arctic Circle the diurnal dies out, or rather merges into, the annual oscillation. Mr. Simmonds's data, so far as they go, support Sir J. Herschel's valuable generalisation.

DISCUSSION.

Mr. C. HARDING testified to the amount of labour represented in the discussion by Mr. Simmonds of the values given in this paper. He was not at all surprised to see that Mr. Strachan did not consider the results altogether confirmed the approximate formulæ given by Mr. Rundell for the change of the several components, and quoted in this paper. It seemed that the data at present existing were not sufficient for the satisfactory determination of such formulæ. With respect to the formula for the variation of the semi-circular component, it seemed

* Quarterly Journal, Vol. V. p. 41.

a question whether the value $\sin^2 2$ lat. was correct, in any case it would appear doubtful whether the data at present existing supported the value of the semi-circular component, being zero at the Equator. With respect to the formula for the sextantal component, the values in Mr. Strachan's paper showed this to be less in the tropics than in the temperate zone. Owing to the smallness of the value of the sextantal component it would doubtless be very difficult to detect the law governing any change. It was to be regretted that the monthly values had not been given, since they had been calculated by Mr. Simmonds, and contained many points of interest, some of which would some day probably assist in the discovery of the governing laws.

Mr. SCOTT remarked that the small number of stations in the table, was owing to the fact that Mr. Simmonds had been especially careful in the selection of his material, and only picked out those stations where two-hourly observations were made for a period not less than 5 years, except at Ascension. M. Boussingault had recently communicated to the Paris Academy 'Comptes Rendus,' vol. 88, pp. 1158 and 1240, a paper on the diurnal oscillation of the barometer, based *inter alia* on observations made on the Andes, which, it was hoped, would throw some further light on the subject.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

NOVEMBER 19th, 1879.

Ordinary Meeting.

CHARLES GREAVES, M.Inst.C.E., F.G.S., President, in the Chair.

Capt. CHARLES KENNEDY BROOKE, F.R.G.S., Army and Navy Club, Pall Mall, S.W.
Rev. EDMUND CARR, M.A., Dalston Vicarage, Carlisle;
Commander ROBERT ATHERTON EDWIN, R.N., Marine Department, Wellington, New Zealand;
WILLIAM BUDDS FAWCETT, 8 Main Street, Limavady, Co. Londonderry;
CHARLES JAMES HARLAND, Castle College, Torquay;
JOSEPH LUCAS, F.G.S., Tooting Graveney, S.W.;
HENRY MELLISH, Hodsock Priory, Worksop;
GEORGE BENJAMIN NICHOLS, Handsworth, Birmingham;
The Right Hon. EARL of NORTHESK, 76 St. George's Square, W.;
JOHN ROBB, M.D., Beechlea Cottage, Cuparstone Road, Aberdeen;
THOMAS HATFIELD WALKER, F.C.S., Westfield House, Stapleton, Carlisle; and
CLEMENT LINDLEY WRAGGE, F.R.G.S., Farley Cottage, Cheadle,
were balloted for and duly elected Fellows of the Society.

Mr. J. S. DYASON and Mr. C. HARDING were appointed Auditors of the Treasurer's Accounts.

The following Papers were read:—

"Report on the Phenological Observations for 1879." By the Rev. THOMAS ARTHUR PRESTON, M.A., F.M.S. (p. 1.)

"Notes on the Meteorology of Zanzibar, East Africa." By JOHN ROBB, M.D., F.M.S. (p. 30.)

The Meeting was then adjourned.

December 17th, 1879.

Ordinary Meeting.

Charles Greaves, M.Inst.C.E., F.G.S., President, in the Chair.

Thomas Buckland, Wraysbury, Staines, and
George Wigner, F.C.S., 79 Great Tower Street, E.C.,
were balloted for and duly elected Fellows of the Society.

The following Papers were read :—

"On a Sandstorm at Aden, July 16th, 1878." By Lieut. Herbert H. Russell. (8th Regt.)

About 5.30 p.m., as I and some friends were sitting in my room, which faced to the north, a very remarkable darkness suddenly came on, giving a peculiar and ghastly tint to the white sand of the neighbouring plain. We went out, and looking westward, saw vast curling masses of sand, in appearance resembling dense black and yellow smoke, driving before the gale which had now been blowing for two days. This cloud came rapidly up the harbour, successively obscuring Little Aden, the ships, and the rocky islets, till nothing remained visible but Slave Island on our right, Shum-Shum on our left, and in front half-a mile of sea, with two native Dhows at anchor in-shore. The varied lights, quickly changing, were curious and most grand ; this last in particular ; the sea, a clear green, with the crests of the waves driving in spray before the wind ; whilst Slave Island and Shum-Shum, usually of an arid brown colour, were turned to an ashy white ; our faces, at the same time, had a ghastly hue ; which was the more strange as the clouds of sand were black, yellow and deep orange. As the storm now burst upon us, we ran inside and closed the doors. Almost immediately the room became so dark that we could not see a yard before us. The storm continued rushing past with great velocity, howling dismally through the chinks and crevices of the building ; several doors were torn off their hinges and some panes of glass were broken. This lasted for some 20 minutes, at times permitting a faint orange light, which again vanished, leaving us in inky darkness. As it cleared, and we thought the storm had passed, the wind suddenly changed to N, and brought it back again, though now not nearly so bad as at first. In about 30 minutes we could see down the harbour, where the shipping was apparently uninjured.

It is difficult to imagine anything more terrible or grand than the appearance of this storm as it advanced up the harbour. The velocity of its march was very great : it could not have taken more than 4 or 5 minutes to travel the 6 miles from Little Aden. Similar storms have been known from our earliest acquaintance with the country, but this was the most terrible within the memory of 'the oldest inhabitant.'

We heard, the next day, that some of the ships had parted their cables, or dragged, but sustained no further damage ; though ashore, several houses have been half-unroofed.

DISCUSSION.

Mr. Laughton remarked that there was a graphic account of a similar sandstorm in Palgrave's 'Arabia,' and said that Baddeley, in "Investigation of the Dustorms and Whirlwinds of India," attributes the whirling storms to electricity, and states that sometimes at least they travel as fast as a horse can gallop. These, however, seem different from that described in the paper.

Mr. Lecky stated that Atkinson gave a very good engraving of a sandstorm in Siberia. It was generally supposed that sandstorms were largely due to electricity.

Mr. Symons said that with respect to the darkness mentioned in the paper, he did not think a stronger instance of darkness could have occurred than that

which took place at Camden Town, on Saturday morning the 13th instant. At 9 a.m. the light of day gradually began to diminish, and by 9.30 a.m. it was necessary to have recourse to artificial light. A little while afterwards hardly anything could be seen out of doors, and putting the lights in his study nearly out, the room having an exceptionally large window facing SW, he placed a sheet of white paper on a table covered with black leather in front of the window and found that it was impossible to see it. This continued from about 10 to 11.20 a.m. He repeated the experiment at 7 p.m. the same evening; and could then distinctly see the paper.

Mr. FIELD said that he could quite corroborate what Mr. Symons had said respecting the darkness on Saturday morning the 13th of December. As he was coming by railway, at about 9 a.m., from Hampstead Heath, it was comparatively clear, but on nearing Camden Town it began to get very dark, and when within ¼ of a mile of Mr. Symons' house, at 9.30, it was pitch dark. From Camden Town he proceeded to Westminster by omnibus, and found that it was exceedingly dark for some time and that it then gradually got lighter till, in the Tottenham Court Road, at about 9.50 a.m., there was only an ordinary fog, which continued to Westminster, proving that the darkness was local. About 10.30 it became dark at Westminster, but not so dark as at Camden Town. It also became very dark at Hampstead between 10 and 11 a.m.

Capt. TOYNBEE asked whether there was any fog at the time of the darkness?

Mr. SYMONS said that there was a good deal of fog above the tops of the houses, but very little near the ground.

Mr. SCOTT remarked that he had generally noticed that when great darkness was observed, although there was always fog above, it was clear at the ground level.

Lieut. CARPENTER said that he had once seen a small duststorm at Halifax. A cricket match was being played on the parade ground, when a small tornado came on, which picked up dust and some heaps of leaves, and travelled along over the course in the form of a pillar, about 80 feet high. He and others had to get out of the way for fear of being caught by it, but it fortunately did no damage. As it passed away some birds were seen to be drawn into it; a pigeon and two small birds were picked up whose beaks, ears, and eyes were choked with dust; the pigeon alone revived on being cleaned. During the time when the dust pillar was most dense it seemed to be revolving on a point. It finally lost form and dispersed.

The PRESIDENT (Mr. Greaves) remarked that probably the earliest accounts of sandstorms were those given by Herodotus. Describing *seriatim* the nations of North Africa, he says: "On the country of the Nasamonians borders that of the Psylli, who were swept away under the following circumstances:—The south wind had blown for a long time, and dried up all the tanks in which their water was stored. Now, the whole region within the Syrtis is utterly devoid of springs. Accordingly the Psylli took counsel among themselves, and by common consent made war upon the south wind (so at least the Libyans say, I do but speak their words); they went forth and reached the desert, but there the south wind rose and buried them under heaps of sand: whereupon the Psylli being destroyed, their lands passed to the Nasamonians."*

Also in Thalia, or Book III., after describing the retreat of Cambyses from Egypt, he wrote: "The men sent to attack the Ammonians started from Thebes, having guides with them, and may be clearly traced as far as the City Oasis. Thus far the army is known to have made its way. It is certain they neither reached the Ammonians, nor even came back to Egypt. Further than this, the Ammonians relate as follows: that the Persians set forth from Oasis across the sand, and had reached about half-way between that place and themselves, when as they were at their mid-day meal, a wind arose from the south, strong and deadly, bringing with it vast columns of whirling sand, which entirely covered up the troops and caused them wholly to disappear."†

From personal experience he could state that sandstorms were very disagreeable things; for when going up the Nile and about half-way between Alexandria and Boulak, but on the Delta side of the river, he was overtaken by a sand-

* Herodotus, Melpomene.
† Herodotus, Rawlinson's translation.

storm which came on from the south-west. The sand was hot, and caused a stinging sensation, proving that the particles of sand must have been of considerable size; but the position was many miles away from the sandy district of the Desert. He was, indeed, at the time on cultivated ground. The storm cloud was high, dense, dark and violent, and the later part of the movement was accompanied by some sense of suffocation and a feeling of foul moisture.

Mr. BEAUFORT remarked that in India these sandstorms were common, and usually came from the NW.

"On a new Form of Hygrometer." By GEORGE DINES, F.M.S. (p. 39.)

"Note on a curious Fracture of a Solar Radiation Thermometer." By G. M. WHIPPLE, B.Sc., F.R.A.S., F.M.S., Superintendent of the Kew Observatory.

DURING last summer we were observing simultaneously at the Kew Observatory the daily indications of a set of five solar radiation black bulb thermometers *in vacuo*. These thermometers were all fixed with their bulbs 4 feet above the surface of the ground, to a wooden frame placed in a nearly horizontal position on the top of a post erected on the Observatory lawn. The instruments being side by side, with the bulbs almost in contact, were held down firmly by wooden clips.

The hailstones, some of which measured 2¼ ins. in diameter, which accompanied the great thunderstorm of the 3rd of August, destroyed three of the thermometers, one escaped uninjured, but the fifth, the subject of this communication, and now submitted to the inspection of the Fellows of the Society, presented on the morning after the storm the remarkable spectacle of a broken blackened thermometer bulb inside an uninjured thin glass vacuum chamber.

At the time I first saw it, the thermometer bulb was still full of mercury, but its upper surface had apparently been chipped off in four fragments which were lying at the bottom of the jacket, and the interior surface of the latter was covered with minute globules of mercury, the result of the evaporation of the exposed mercury into the vacuum.

The only explanation we can offer of the phenomenon is, that the thermometer being a Negretti's maximum, had at the time of the storm a vacuum in the bulb, and that a vibration in the stand must have been set up by the blows of the hailstones, sufficient to throw the mercury against the top of the bulb with enough force to fracture it from the inside.

DISCUSSION.

Mr. CASELLA attributed the peculiar kind of fracture of the thermometer bulb shown to some sudden means by which it had been overheated, which might have been caused by a flash of lightning.

Mr. SYMONS thought that it could not have been caused by a flash of lightning, as the corks inside the protecting tube were not burnt.

Mr. WHIPPLE stated that Mr. Miller, of Lowestoft, had written to him stating that he had once had a somewhat similar breakage of a solar thermometer.

Mr. S. H. MILLER, in a letter to the Secretary, remarked :—

"In 1860 Messrs. Negretti and Zambra supplied me with a solar radiation thermometer. This was a 'naked' instrument, and the bulb was rather larger than those made at the present time. I used the instrument 5 years ; it was placed on forks, 3 ins. from the grass. At the end of the 5th year the makers put the thermometer into a vacuum jacket for me, making the bulb a dull black (I had already procured another instrument in a vacuum), and I placed it again in its old position.

"Some two years or more after this, I found the instrument thrown off one of the forks. I felt certain this was done during the night by a cat ; there was a wire guard around the instrument. On examination I found the vacuum jacket intact ; the stem of the thermometer intact also, but a small triangular-shaped portion of the blackened bulb and the mercury were lodged in the bulb of the vacuum jacket. I took the instrument in this state to the makers, who appeared as much puzzled as myself to account for the fracture, for nothing

could have touched the bulb—the fall was so slight—it had not been *rigidly* fixed, and it appears to me that the force of the mercury returning to the bulb could not have been greater than when the instrument was set daily—and the contraction of the neck would prevent the whole column of mercury, supposing the instrument had been thrown up first so as to fill the bore of the stem, from returning suddenly to the bulb."

"Diurnal Range of Atmospheric Pressure." By RICHARD STRACHAN, F.M.S. (p. 42.)

"Description of the Card Supporter for Sunshine Recorders adopted at the Meteorological Office." By Professor GEORGE GABRIEL STOKES, M.A., F.R.S.*

The Meeting was then adjourned.

RECENT PUBLICATIONS.

ANNALES DE L'OBSERVATOIRE ROYALE DE BRUXELLES. 1878. 4to.

Contains :—Discussion des Observations d'Orages faites en Belgique pendant l'année 1878, par A. Lancaster. The months of May and June were unusually stormy, giving, at a majority of the stations, one-half of the whole number of storms observed during the year, instead of one-third, as is generally the case: they were also characterised by a low barometer and a frequency of heavy rains. The storms of the year were not remarkable for their intensity.

ANNALES DU BUREAU CENTRAL METEOROLOGIQUE DE FRANCE. Année 1878. I. Etude des Orages en France et Mémoires divers. 4to.

This is the first of the regular publications of the recently organised French Meteorological Office. The introduction contains an account of the formation of the office, and the report of the President of the Council on the first year's work. This is followed by a number of papers on the storms of the years 1876-79; by one on the observations of underground temperature, made at the Muséum d'Histoire Naturelle; and by—Etat des glaces, époques de la végétation et de la migration des oiseaux en Suède, par H. H. Hildebrandsson.

ANNUAIRE DE LA SOCIETE METEOROLOGIQUE DE FRANCE. Tome XXVII., 1879. Bulletin des Séances, feuilles 10-13. 8vo.

Principal contents :—Tables nouvelles pour réduire au niveau de la mer les hauteurs barométriques, par A. Angot.—Sur les dernières crues de la Seine, par L. Lalanne et G. Lemoine.—Note sur les grands verglas observés à Vendôme (Loir-et-Cher) le 8 janvier et les 22-23 janvier 1879, par Prof. E. Nouel.

BAIRD'S ANNUAL RECORD OF SCIENCE AND INDUSTRY. 8vo.

The article on the "Physics of the Globe" has been prepared by Prof. C. Abbe. This consists of short notices of books, papers, and in fact of everything known to be published on any subject that may be included in the title "Physics of the Globe."

JOURNAL OF THE ROYAL INSTITUTION of CORNWALL. No. XXI. 8vo.

This contains 2 papers by Dr. C. Barham :—1. On the relations of Land and Sea Temperature in the South-west of England; and 2. Note on the Winter of 1878-9.

LANDWIRTHSCHAFTLICHES JAHRBUCH. Band VIII. 8vo.

Contains :—Plan für ein meteorologisches Beobachtungsnetz im Dienste der Landwirthschaft des Königreichs Preussen, von Dr. G. Hellmann. In this paper

* This Paper will appear in the next No. of the Journal.

the author gives an account of the simple climatological observations made in the principal states of Europe, and then advances a plea for the organisation of meteorological observations for agricultural purposes in the Prussian Kingdoms.

METEOROLOGIA ITALIANA. Memorie e Notizie. Anno 1878, Fascicolo V.

Contains :—Leggi delle variazioni dell'Elettricità atmosferica dedotte dalle regolari osservazioni fatte all' Osservatorio di Moncalieri nel dodecennio 1867-1878, del P. F. Denza.—Forme di neve osservate in Pavia nell' inverno 1878-79, del Dr. C. Chistoni.—Esame di alcune formole psicrometriche, del Dr. C. Chistoni.

MONTHLY NOTICES OF THE METEOROLOGICAL SOCIETY OF MAURITIUS. June and August, 1879.

Contains the following papers by Mr. C. Meldrum :—Rainfall of Mauritius in 1878 ; Gale of February 26th, 1879 ; Incurving of the Wind in Cyclones ; Sun-spots and the Rainfall of Paris.

PROCEEDINGS OF THE ROYAL SOCIETY. Vol. XXIX., No. 198. 8vo.

Contains :—Preliminary Report to the Committee on the Solar Physics on the evidence in favour of the existence of certain short periods common to Solar and Terrestrial Phenomena, by Prof. B. Stewart, and W. Dodgson (22 pages). The Meteorological and Magnetic inequalities at Toronto, Kew, Utrecht and Prague are discussed ; and it is suggested that between these and certain solar inequalities shown by provisional sun-spot records, there is a correspondence in point of period.—Report of the Kew Committee for the year ending October 31st, 1879.

REPERTORIUM FUER METEOROLOGIE HERAUSGEGEBEN VON DER KAISERLICHEN AKADEMIE DER WISSENSCHAFTEN. Redigirt von Dr. H. Wild. Band VI., Heft 2. 4to. St. Petersburg.

Contains :—Die Vertheilung der Winde über dem baltischen Meere, von M. Rykatschew.—Vergleichung der Normalbarometer von St. Petersburg, Dorpat, Helsingfors, Stockholm und Upsala, nebst allgemeinen Bemerkungen über die Reduction des Barometers auf die Normaltemperatur, von G. Hellmann.—Aufstellung der Thermometer zur Bestimmung der wahren Lufttemperatur, von H. Wild.—La Marche diurne du baromètre en Russie, et quelques remarques concernant ce phénomène en général, par M. Rykatchew (194 pages).—Ueber die Seehöhen der meteorologischen Stationen in Sibirien auf Grundlage neuer Isobaren, von E. Stelling.—Jahresbericht des physikalischen Central-observatoriums für 1877 und 1878, von H. Wild.

REPORT OF THE PROCEEDINGS OF THE SECOND INTERNATIONAL METEOROLOGICAL CONGRESS AT ROME, 1879. Published by authority of the Meteorological Council. 8vo.

[See Vol. V., p. 237, of the Quarterly Journal.] In the Appendix is a valuable report on the condition of the various meteorological organisations in Europe, &c.

REPORT ON THE METEOROLOGY OF INDIA IN 1877. BY JOHN ELIOT, M.A., Officiating Meteorological Reporter to the Government of India. Third year. 4to.

The Report itself extends to 173 pages, and is an elaborate discussion of the Meteorology of 1877, over the whole of India. Owing to the interest which the deficient rainfall of the past two years has excited in the question of the secular and periodic distribution of rainfall in India, great progress has been made in bringing together the records of past years, and the present Report contains a table of the average monthly and annual rainfall at 306 Stations; the average in many cases being for more than 20 years. Uniformity in the method of determining the temperature of nocturnal radiation is secured by placing the thermometer on a thick pad of woollen blanket. The work is accompanied by two Appendices occupying 375 pages ; the 1st contains an abstract of the registers for about 100 stations (the rainfall being for 311), and the 2nd gives the detailed daily observations for 6 stations.

Report on the Meteorology of Kerguelen Island. By Rev. S. J. Perry, S.J., F.R.S. Published by the authority of the Meteorological Council. 4to.

The observations included in this report were taken in the winter of 1840, by Sir James Ross, in the Antarctic Expedition, in January, 1874, by Sir G. Nares, in H.M.S. "Challenger," and in the summer months of 1874-5 by the transit of Venus observers.

Sur la Classification des Nuages employee a l'observatoire Meteorologique d'Upsala par H. H. Hildebrandsson. Photographies de M. Henri Osti. Edition de 60 exemplaires publiée aux frais des fonds de la donation Letterstedt. 4to.

This is a collection of 16 beautifully executed photographs of specimens of typical clouds, and is accompanied by a concise statement of the different forms of cloud according to Luke Howard's nomenclature, as it has been understood and applied during the past 15 years at Upsala.

Transactions of the Devonshire Association for the Advancement of Science, Literature and Art. 1879. 8vo.

Contains the 4th Report of the Committee on the Meteorology of Devonshire. This Committee was appointed for the purpose of making and obtaining observations, on a uniform system, on the meteorology of the county of Devon. The present report gives the results of the observations for 1878, as recorded at 12 stations.

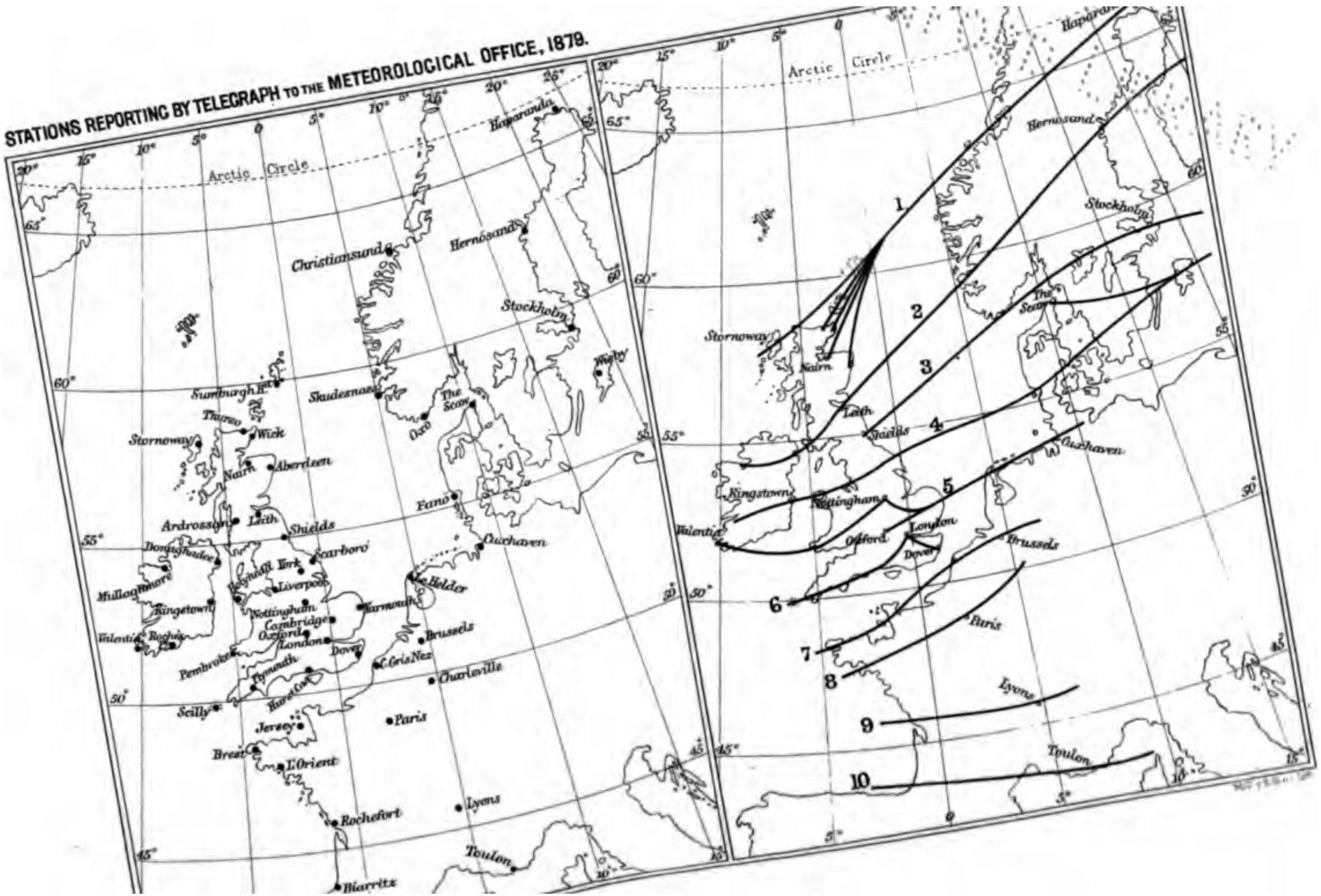
Transactions of the Watford Natural History Society and Hertfordshire Field Club. Vol. II., part 6. 8vo.

Contains:—Reduction of Meteorological observations, by W. Marriott.—Meteorological observations taken at Watford during the year 1878, by J. Hopkinson.—Also reports on the Rainfall and Phenological observations in Hertfordshire, in 1878.

Zeitschrift der Oesterreichischen Gesellschaft fuer Meteorologie. Redigirt von Dr. J. Hann. November, 1879—January, 1880. 8vo.

Contains:—Die Resultate der bisherigen photochemischen Messungen des Sonnenlichtes, von J. M. Pertner.—Eine Erweiterung der Neumann'schen Methode zur Kalibrirung von Thermometern, von M. Thiesen.—Ueber die mittlere Temperature und den mittleren Luftdruck zu Wien, von Dr. J. Hann.—Beiträge zur Kenntniss der Böen und Gewitterstürme, von Dr. W. Köppen.—Die Trägheitscurven auf rotirenden oberflächen als ein Hilfsmittel beim Studium der Luftbewegung, von Dr. A. Sprung.—Zur Theorie die oberen Luftströmungen, von Dr. A. Sprung.—Das Evaporimeter "Piche" und seine Angaben in Beziehung zur Verdampfung freier Wasserflächen, von Prof. M. Kunze.

STATIONS REPORTING BY TELEGRAPH TO THE METEOROLOGICAL OFFICE, 1879.



QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. VI. No. 34.

An Address delivered by the President, CHARLES GREAVES, M. Inst. C.E., F.G.S., *at the Annual General Meeting, January 21st*, 1880. (Plate III.)

THE multitude and variety of the subjects connected with Hygrometry lead me once more to submit to you a small endeavour to facilitate its study.

I shall not on this occasion make any attempt to correct or criticise, or to give you any views of my own, except so far as they may lead me to express the desire that this branch of the science may be more worked. In common with many others I was some time since led to hunt up what knowledge I could as to the movement of the atmosphere in its hygrometric relations, and although I obtained some insight into the views of other students of the subject, I found but few data arranged ready to hand by which to test expressed opinions, or on which I could frame any hypothesis.

The subject of my inquiry eventually formulated itself into the following questions: Where does the moisture which is found over Western Europe come from? Is it plain that it has a general motion? Does it all come from the Atlantic? Or from beyond the Atlantic? Is the mass, or the focus, or the maximum always moving Eastward? Is its motion similar in time, interval, and speed, with that of the general atmosphere, or has it a place and pace of its own? Does it come to us by descent from the higher atmosphere, or does it pass from us by ascent to the upper strata? Is it entirely destroyed by precipitation, or is it finally extinguished by coming into contact with the cold of the Arctic or more northern regions?

On further consideration it seems clear that the atmosphere at large has hygrometric conditions, which must be subject to changes of position in the latitude and longitude of the earth, analogous to those changes which may be generally termed "baric."

I allude now to hygrometric conditions more in reference to the amount of moisture present in the atmosphere, than in reference to the levity of the whole, due to the presence of that moisture; but it will be well to keep in mind that all moisture in combination with air *more atmospherico*, tends to reduce the specific gravity of that air, and *tanto quanto*, and that therefore saturated air is lighter per cubic foot than drier or more pure air, such as we imagine the simple mixture of oxygen and nitrogen to be.

Now I suppose we have nowhere a more beautiful set of observations than those which form the Daily Weather Report of the Meteorological Office, and it appeared to me when dipping into this matter last summer that we did not do justice either to ourselves or the Meteorological Office if the Daily Reports were not arranged in some compendious form to show the consecutive changes of the atmosphere in its hygrometric aspect from day to day at all their stations.

More than this, the baric relations are drawn (*i.e.* charted) already, and the cyclone and anticyclone forms of movement are exhibited in the Daily Weather Charts founded on the best experience that we can have. The question becomes this, Are their determined sequences regular or irregular? (in rough language, What follows what?) Is it possible at any time to map the hygrometry of the atmosphere? This appears to me to be not only possible, but to be the next proper study to be undertaken.

Having got thus far, I looked about for what there might be of a digest of the daily record, but could find none either ready or in preparation, nor could I learn anything that led me to imagine that the Meteorological Office kept such a thing in constant progress among their archives, if they have any. My only resource was to see if it could be done by a private individual, and in a tabular way; for I saw that to chart every day's hygrometry would produce such a quantity of paper that the mind would with difficulty institute a comparison and with still more difficulty draw an inference.

Hereafter we may perhaps chart something; lines of equal moisture may be made as palpable as Isobars, and "Isotens" may become familiar on Weather Charts.

Moisture, however, roughly speaking is not more than about one or two per cent. of the total weight of the atmosphere under mean conditions; it must therefore be content to be outweighed, if not controlled, by its heavier partner, though nevertheless its own motions are deserving of more study.

I found, however, that to tabulate the hygrometric states numerically was a work of no small labour, and having begun it, first of all only aiming at a season, I suffered the ordinary temptation to complete the year, and have been drawn into a larger affair than I at first contemplated; and I now submit the outcome of my work. The Daily Weather Chart system embraces about 51 stations, more or less; 28 British and 23 foreign. The Chart is produced with most exemplary regularity; it has in it evidently but few errors that belong to the reduction, and I may say the editing; it covers an area on the globe extending from 10° W long. to 25° E long., and from 44° to 66° N lat., and almost all its stations furnish dry and wet bulb observations; moreover,

we have the observations themselves. Still it would add greatly to our materials for generalisation if stations in Iceland could be added to the schedule as well as Gibraltar, the Azores and Bermuda.

It would be more than ordinarily interesting if some balloon observations could be procured to indicate to us the movement or progressive condition in vertical lines of the hygrometry of the upper air; but we have not, as yet, made much progress towards this. Possibly the attention now given to elevated stations may help us. On all grounds, observations in such positions are desirable—eminently desirable—as at present we do not appear to be in possession of any scale of moisture varying in degree with height. It appears to be, therefore, more our duty to verify the reality of the common idea that the watery components of the atmosphere travel along with the general body, and from west to east.

But it is advisable here to notice the idea put forward by Prof. Mohn in his 'Storm Atlas,' that there are on the earth's surface beds of vapour which may be so far stationary that they are growing on the one side, and wasting on the other, without suffering entire translation of their position on the globe.

This is not a subject for averages, and I have, therefore, not gone far in endeavouring to exhibit mean results, but I have made the endeavour to get a view from day to day, and every day for a year, of the hygrometric condition of the air at 8 a.m. The arrangements are uniform, and therefore the series is unexceptionable: it is available now for any and all of the years since 1873.

There is no difficulty in adding results of averages to what I have done; indeed, my digested table is absolutely necessary in anticipation of reducing to averages the moisture values from all the stations for the months and years during which the observations have been continued.

The stations are in great part coast stations, so that the results may be said to have a littoral character, being however rather irregularily laid out; that is, with reference to any power the mind may have towards grasping their relation to any co-ordinating idea.

I have thrown them into series, on lines which may be roughly considered as Rhumbs, or SW and NE, or W and E, courses. There does not seem to be any more general hypothesis than that of a SW and NE course, being the general line of movement of the atmosphere obtained from a study of its baric elements; the same would rule as to its hygrometric qualities, and I think it would be found that, with this in view, the different stations can thus be easily classified with a view to the search for the order of degrees of moisture, of change of moisture, direct, reverse, retrograde or otherwise, or of its permanent existence.

As I said at the commencement, I am not propounding any theory. This is only a preface to the sheet of figures in which the movement can be seen. If no result can be obtained from a study of such tables as these, it is difficult to see to what grand use the observations are to be put, and consequently difficult to see what benefit will arise from their continued daily publication beyond what appertains to their use and purpose in respect of storm warnings

and forecasts. Not that I say this as a critical or invidious remark, but rather in the desire to make them of greater use.

The synchronous view we have at once when the Daily Weather Charts and Observations are issued; the sequences can only be obtained by some such display as that I am now exhibiting; and if the Meteorological Office contemplate any such issue from their own hands, I will not deal further with such a heap of figures. The mind and memory cannot charge themselves with a succession of maps, and I am of opinion that something of a condensed or concise form is wanted to bring the consecutive conditions into close approximation for a grasping view.

The following Tables are specimens of the sheets which contain similarly arranged reductions of the whole 50 stations for each month of the year 1879:—

8 a.m. Observations and Hygrometric Deductions extracted from the Daily Weather Report for

JANUARY 1879.—MULLAGHMORE.

Date.	Difference between Dry and Wet Bulbs.	Dry Bulb.	Wet Bulb.	Dew Point.	Thermometric Dryness. Diff. between Air and Dew Point.	Tension of Vapour.	Relative Humidity.	Rain.	Weather.	Wind. Direction.	Wind. Force.
	°	°	°	°	°	In.	o/o	In.			
1	2	38	36	33·3	4·7	·190	83	·18	bc	N	4
2	2	34	32	28·5	5·5	·156	79	..	bc	SW	4
3	0	34	34	34·0	0·0	·196	100	..	c	E	5
4	2	38	36	33·3	4·7	·190	83	..	c	NNW	3
5	1	34	33	31·2	2·8	·176	89	·02	b	E	4
6	4	39	35	29·7	9·3	·164	70	..	ow	SE	6
7	2	42	40	37·5	4·5	·225	85	·25	og	ESE	6
8	2	37	35	32·2	4·8	·182	83	·26	og	ESE	6
9	1	34	33	31·2	2·8	·176	89	..	b	SE	6
10	5	37	32	24·9	12·1	·134	61	..	o	SE	7
11	..	31	..	..	..	..	..	..	c	ESE	5
12	2	35	33	29·8	5·2	·164	80	..	og	E	5
13	2	45	43	40·7	4·3	·253	85	·26	bc	SW	6
14	2	49	47	44·8	4·2	·298	86	·20	c	SW	6
15	5	45	40	34·2	10·8	·197	66	·10	ogq	WNW	7
16	1	36	35	33·5	2·5	·193	91	..	bc	ESE	4
17	2	40	38	35·4	4·6	·207	84	..	ow	SE	7
18	2	42	40	37·5	4·5	·225	85	·28	b	SSW	5
19	2	40	38	35·4	4·6	·207	84	..	bcq	SE	6
20	1	36	35	33·5	2·5	·193	91	·04	tsw	ESE	7
21	1	37	36	34·6	2·4	·200	91	·06	og	ESE	6
22	2	32	30	25·4	6·6	·137	75	..	b	ESE	4
23	..	27	..	..	..	..	..	..	bc	SSW	1
24	3	32	29	23·3	8·7	·125	69	..	o	ESE	3
25	1	31	30	27·3	3·7	·148	85	..	b	SE	4
26	0	32	32	32·0	0·0	·182	100	..	c	SW	1
27	1	36	35	33·5	2·5	·193	91	..	m	ENE	3
28	1	40	39	37·7	2·3	·226	92	·02	c	E	1
29	2	38	36	33·3	4·7	·190	83	·02	og	ESE	5
30	2	35	33	29·8	5·2	·164	80	..	o	E	5
31	2	35	33	29·8	5·2	·164	80	..	mg	ESE	5

8 a.m. Observations and Hygrometric Deductions extracted from the Daily Weather Report for

JUNE 1879.—YARMOUTH.

Date.	Difference between Dry and Wet Bulbs.	Dry Bulb.	Wet Bulb.	Dew Point.	Thermometric Dryness. Diff. between Air and Dew Point.	Tension of Vapour.	Relative Humidity.	Rain.	Weather.	Wind. Direction.	Wind. Force.
	°	°	°	°	°	In.	o/o	In.			
1	4	54	50	46·1	7·9	·310	74	·37	bc	WSW	4
2	5	53	48	43·0	10·0	·277	69	·10	b	WSW	3
3	1	54	53	52·0	2·0	·388	93	·40	or	WSW	2
4	2	50	48	45·9	4·1	·309	86	·17	bc	WSW	4
5	2	54	52	50·0	4·0	·360	86	..	b	NNE	1
6	1	51	50	49·0	2·0	·348	93	·04	or	E	3
7	0	52	52	52·0	0·0	·388	100	·07	f	Z	0
8	3	61	58	55·4	5·6	·439	82	·22	b	SSW	2
9	2	58	56	54·2	3·8	·421	87	·04	c	SSW	2
10	4	59	55	51·4	7·6	·380	76	..	b	WSW	1
11	3	56	53	50·2	5·8	·365	81	..	b	ESE	2
12	2	59	57	55·2	3·8	·436	88	·06	b	Z	0
13	2	56	54	52·1	3·9	·391	87	·23	bc	SSE	1
14	1	52	51	50·0	2·0	·361	93	..	c	S	1
15	1	57	56	55·1	1·9	·434	93	..	of	S	2
16	1	53	52	51·0	2·0	·374	93	·23	f	NNE	2
17	3	59	56	53·3	5·7	·407	82	·03	bc	WSW	2
18	1	53	52	51·0	2·0	·374	93	..	o	NW	1
19	7	60	53	46·8	3·2	·321	71	..	b	W	1
20	1	58	57	56·1	1·9	·451	93	·02	od	S	2
21	2	57	55	53·2	3·8	·405	87	..	o	SSW	2
22	3	56	53	50·2	5·8	·365	81	·08	cq	SW	4
23	4	57	53	49·3	7·7	·351	75	..	bc	SW	1
24	3	58	55	52·3	5·5	·393	81	..	c	S	4
25	2	54	52	50·0	4·0	·360	86	·20	cf	SW	2
26	7	57	50	43·6	3·4	·283	61	·26	bc	SW	3
27	1	59	58	57·1	1·9	·467	94	·04	c	SW	2
28	2	62	60	58·3	3·7	·487	88	..	c	WSW	2
29	4	60	56	52·5	7·5	·395	76	·09	b	SW	2
30	4	59	55	51·4	7·6	·380	76	·04	b	WSW	3

List of Stations and Rhumbs.

No. of Rhumb.	No. of Stations in Rhumb.	Names of Stations in Rhumb.
1	8	Stornoway, Thurso, Wick, Nairn, Aberdeen, Sumburgh Head, Christiansund and Haparanda.
2	6	Mullaghmore, Donaghdee, Ardrossan, Leith, Skudesnaes and Hernosand.
3	3	Shields, Oxö and Stockholm.
4	9	Valentia, Kingstown, Holyhead, Liverpool, York, Scarboro' or Spurn Head, Fanö, Skaw and Wisby.
5	9	Valentia, Roches Point, Pembroke, Oxford, Nottingham, Cambridge, Yarmouth, Helder and Cuxhaven.
6	5	Scilly, Prawle Point, Hurst Castle, London and Dover.
7	4	Brest, Jersey, Gris-nez and Brussels.
8	3	Lorient, Paris and Charleville.
9	2	Rochefort and Lyons.
10	3	Corunna, Biarritz and Toulon.

It will be asked of course what results have I met with, and what deductions have I made; but the year is so recently closed, the corrections are not yet all reported, the sheets of figures have proved so voluminous, that altogether to digest fully the information to which this form of arranging the Daily Weather Reports gives access has not been possible; but having gone to the trouble of having the work done, it seemed to me desirable to present it for anybody's study rather than to keep it for my own.

The digest of the 8 a.m. hygrometrical observations of the several reporting stations of the Meteorological Office is arranged on 24 sheets, 6 for each quarter of the year 1879.

The 1st sheet	contains	1 Rhumb.	No. 1.
,, 2nd ,,	,,	2 Rhumbs.	Nos. 2 and 3.
,, 3rd ,,	,,	1 Rhumb.	No. 4.
,, 4th ,,	,,	1 Rhumb.	No. 5.
,, 5th ,,	,,	2 Rhumbs.	Nos. 6 and 7.
,, 6th ,,	,,	3 Rhumbs.	Nos. 8, 9, 10.

The 2nd, 3rd, and 4th quarters are the same arrangement repeated.

REPORT OF THE COUNCIL

FOR THE YEAR 1879.

In presenting their Report on the present occasion, the Council trust that the satisfactory position of the Society therein disclosed, will be accepted by the Fellows as a proof of their endeavour to promote the interests of the Society to the best of their ability.

The large proportion of Fellows devoted to agricultural pursuits, elected during the present year, has induced the Council to institute a new class of stations of a third order, to be termed "Climatological," at which observations of temperature, humidity, cloud, and rainfall should be taken daily at 9 a.m. only, with certified instruments, the thermometers to be in Stevenson's screens, so that the observations of temperature at the different stations may be strictly comparable. The difficulty of finding persons willing to take observations at 9 p.m., and the large amount of labour and expense involved in their reduction, are a serious obstacle at present to the extension of second class stations beyond the number, 30, already decided upon, so that, unless stations of the third order were organised, a comparison of the climate at an additional number of places, so much to be desired for researches connected with health and agriculture, could not be carried out by the Society. The great local differences in temperature and humidity require to be more accurately ascertained than they are at present, and this remark applies not only to sea-side places, but also to inland districts in their

relation to hills and valleys. It is with a view to obtaining better knowledge on this subject that the Climatological Stations have been established. The forms adopted for recording the observations at the stations and in the Society's Journal are as follows :—

Climatological Observations at 9 a.m., made at ________________________

________________________188 .

Date.	Thermometers.				Amount of Cloud.	Rain.	Remarks.
	Dry.	Wet.	Max.	Min.			
	°	°	°	°	0—10	In.	
1 2 3 4 &c.							

The results will be published in the following form:—

Returns from the Climatological Stations for the three months ending March 1880.

Station.	January.												
	Means at 9 a.m.		Temperature.							Mean Amount of Cloud at 9 a.m.	Rain.	
			Means.				Extremes in Month.					
	Temperature.	Humidity.	Min.	Max.	Range.	Mean.	Min.	Max.	Range.		Amount.	No. of Days.
	°	o/o	°	°	°	°	°	°	°		Ins.	

An opportunity having occurred of acquiring at a small additional rent the room adjoining that already occupied by the Society at 30 Great George Street, Westminster, the Council decided on taking it, as although the accommodation had become too limited for the requirements of the staff, and often caused loss of time, the difficulty of procuring sufficiently large rooms elsewhere at a moderate rent, and the cost of removal, had hitherto prevented them from taking other offices. They have for the present all the appliances necessary for Council meetings and for the work of the office.

The total cost of the change, including new furniture, carpet and fittings, has been £50; and the increased rental is £13. The Fellows now have a comfortable room for their use, containing the Library, separate from the apartment occupied by the computers. The Council appointed a special Committee consisting of the President, Dr. Tripe, Messrs. Eaton, Field, and Lecky, to consider the question and report, which they did at a special meeting held in July last, when they, with Mr. Symons added, were empowered to carry out the necessary arrangements.

As the work connected with the organisation of new stations, and of preparing forms for recording the meteorological observations was nearly completed last year, the Council did not reappoint the Station Committee, but merged it in the House Committee under the title of the General Purposes Committee. It consists of 7 members, viz., the President, 3 Secretaries, Messrs. Eaton, Ellis, and Tabor. As the name implies, most matters requiring special consideration, except those relating to the editing of the Journal, are referred to this Committee for consideration and report. The Editing and Publication Committee was also continued, and Messrs. Eaton, Laughton, and Scott, were appointed to superintend this important subject; the Council need only refer to the Journal itself to show how much labour has been bestowed on this work. The General Purposes Committee held 10 meetings during the year, which were attended on an average by 6 members. The Editing Committee seldom meet, as the MS. is forwarded from one member to another for correction.

The result of the inspection of the Society's stations has been satisfactory, and with the exception of some of the wet bulb thermometers, which had an encrustation of lime on the muslin, everything was found in fair condition. Observers cannot be too particular in changing the muslin and conducting thread of the wet bulb sufficiently often, so as to ensure the proper working of the instrument; and it is also necessary to impress upon them that rain or distilled water should, if possible, be used. Marine barometers are considered by the Council objectionable for the second-class stations; they are sluggish in action, and consequently do not follow the changes in the atmospheric pressure so quickly as those ordinarily employed. Some of the minimum thermometers were so covered at the upper end of the stem as to render it impossible to see if spirit had collected there, a defect invalidating the observations. It was therefore decided to send a circular to the leading opticians directing attention to this objectionable mode of mounting, in the hope that it will be discontinued. It having been reported by the Station Committee that many of the wet-bulb observations were defective during the severe weather in the early part of the year, the Council desire to notify the great care required in the manipulation of that instrument in frosty weather.*

As nearly all the Society's stations were inspected last year, the undermentioned only have been visited during the present year, viz :—

* Instructions for the management of the dry and wet bulb thermometers are given in the Quarterly Journal, Vol. III, pp 289-291.

Audley End.	Dartmoor.	Mansfield.
Bournemouth.	Downside.	Scaleby.
Buxton.	Eastbourne.	*Scarborough.*
Cheltenham.	Gainford.	Shrewsbury.
Croydon.	Lowestoft.	

The names of the new stations are printed in italics.

For a list of stations and the names of observers, see page 30 of the Abstract of Meteorological Observations taken during the year.

The observations at Hereford, one of the Society's stations from which copies of the observations were furnished to the Meteorological Council, were discontinued at the end of 1878. In place of this, the Meteorological Council have accepted the returns from Cheltenham.

The Council have resolved to apply to Meteorological observers for monthly summaries of their observations for any year within the last decade. It is proposed carefully to examine and check these returns, and to arrange them in such a manner as to exhibit the comparative climate of the country for the decennial period ending December, 1880, such work being in accordance with the recommendation of the International Meteorological Congress. A form for collecting the returns has been decided upon, and it is intended to issue a circular on the subject at an early date. Independently of the interest to Meteorologists which will attach to them, the results will also have a practical bearing on the operations of the farmer and gardener, and also be of great service to engineers and members of the medical profession.

In consequence of the somewhat unwieldy size of the Journal, it has been decided to complete one volume in each year. The volume for 1879 contains 252 pages, besides 42 of the Abstract of Meteorological observations, and 82 of the Meteorology of England by Mr. Glaisher, as published by the Registrar General, making altogether more than 300 pages; there are also a large number of plates and diagrams. This year a few pages in each number of the Journal have been devoted to abstracts of recent works on Meteorology, published in this country and abroad: the Council trust that these will be found useful, as a selection has been made of such works as are deemed of sufficient interest to the majority of the Fellows. A good example is given in the last number (No. 32) of the Journal for 1879, in the notice of "*Comment on observe les nuages pour prévoir les temps, par André Poëy.*" This number also contains notices of works published in France, Germany, Italy, Spain, the United States, India, and the Colonies. The Council would also refer to the diagrams on the daily inequality of the Barometer, published with Mr. Rundell's paper, as an instance in which the assistance afforded by a Society enables an author to lay before the scientific public, information which otherwise would scarcely be issued by any ordinary publisher.

Among the subjects of discussion at the Meetings during the year, the Council would mention the following as proofs that the comprehensive

character of the communications submitted to the Society shows no signs of falling off:—

"*Contributions to the Meteorology of the Pacific. No. III.—Samoan or Navigators' Islands.*" By ROBERT H. SCOTT, F.R.S.

"*Dew, Mist and Fog.*" By GEORGE DINES, F.M.S.

"*Diurnal Range of Atmospheric Pressure.*" By RICHARD STRACHAN, F.M.S.

"*Meteorological Observations on the Peak of Teneriffe.*" By WILLIAM MARCET, M.D., F.R.S.

"*Meteorology of Zanzibar, East Africa.*" By JOHN ROBB, M.D., F.M.S.

"*Observations on the Velocities of the Wind and on Anemometers.*" By G. A. HAGEMANN.

"*On the Inclination of the Axes of Cyclones.*" By the REV. W. CLEMENT LEY, M.A., F.M.S.

"*Report on the Phenological Observations for* 1879." By the REV. T. A. PRESTON, M.A., F.M.S.

The number of Fellows having increased considerably during the last 2 years, it has been found advisable to print an additional 100 copies of the Journal, so that 700 instead of 600 are now struck off. This was necessary as applications for back numbers are frequently made. Again the applications for exchange of publications by Foreign or Colonial Societies or persons eminent in Meteorology having also increased, the list has been revised, and the number of copies of the Journal thus issued now reaches 77, so that provision has to be made not only for the supply of existing and of new Fellows, but also of others who may require them.

At a meeting of the Council held on February 18th, it was resolved that Mr. Scott, the Foreign Secretary, be requested to represent the Society, at the Meteorological Congress which was held at Rome in April, 1879. It is scarcely necessary to point out the value to the Society of such a course of action in extending its influence on the Continent.

The delegates to the Lightning Rod Conference report, *ad interim*, that the Conference has held several meetings and has collected a large amount of information on the subject, but that it is not yet prepared to present its final report.

It has been deemed advisable in the general interests of the Society to hold one meeting a year for the reading of a few brief communications, to be followed by a friendly exchange of opinions thereon, and on Meteorology in general. It is to be hoped that many Fellows besides those who attend the Ordinary Meetings will assist on such occasions.

A change in the practice hitherto adopted, rendered necessary by the large number of new Fellows, is an annual publication of the List of Fellows. Another innovation has also been made, by voting £2 2s. to Mr. W. H. Tooker for taking the observations at Dartmoor, in consequence of Dr. Power having resigned his office of Surgeon to the prison, and ceasing to act as observer. This course was adopted because Dartmoor

being the highest station in England, it is of considerable importance that the observations taken there should be continued. As the instruments were the property of the prison authorities and could not be removed, the Council have been obliged to purchase a new set, and have lent these to Mr. Tooker: the cost was £7 14s.

The donations include a barometer from Mr. Wilkin, and a copy of the Royal Society's Catalogue of Scientific Papers, 8 vols., 4to. The latter was granted by the Lords of the Treasury on a recommendation of the President and Council of the Royal Society, and forms a most valuable addition to the Library of this Society. Numerous other donations have been received during the year, and lists thereof published in the Quarterly Journal. As a single list of donations will be more compact than four, the Council have decided to publish the titles in future only once a year.

The Society has to deplore the loss by death of 2 Honorary Members, and of 14 Fellows, including 3 Past Presidents, whose names, with the dates of their election into the Society, are as follows:—

Honorary Members:—Professor Heinrich Wilhelm Dove (June 18, 1862); and Dr. Johann von Lamont (June 17, 1874).

Fellows:—Charles Brooke, M.A., F.R.S., F.R.C.S. (August 7, 1850); William Malachi Burke, F.R.C.P. (February 20, 1878); Henry Morgan E. Crofton, J.P., F.R.A.S., M.R.I.A. (November 19, 1862); the Earl of Durham (April 16, 1879); Arthur Forbes (March 28, 1854); William Frederick Harrison, J.P. (February 21, 1866); Henry Alexander Kettle, F.R.G.S. (February 19, 1879); John Joseph Lake (November 21, 1877); J. J. Cohen de Lissa, F.S.S. (November 21, 1877); Henry A. L. Negretti (November 27, 1855); William Wilson Saunders, F.R.S., F.L.S. (March 19, 1862); Thomas Sopwith, M.A., F.R.S., M.Inst.C.E. (November 22, 1853); John Waterhouse, F.R.S. (June 16, 1869); and Samuel Charles Whitbread, F.R.S. (April 3, 1850).

The roll of the Society has also been further diminished by 13 resignations and the removal of 7 defaulters, making with the deaths a total loss of 36, against 84 Fellows elected in 1879.

Fellows.	Life.	Ordinary.	Honorary.	Totals.
1878, December 31 ...	85	322	18	425
Since elected	+10	+74	...	+84
Since compounded	+ 1	− 1	...	0
Deceased	− 6	− 8	− 2	−16
Retired	...	−13	...	−13
Defaulters	...	− 7	...	− 7
1879, December 31 ...	90	367	16	473

The following figures show the position of the Society for each year since it procured a Charter of Incorporation in 1866:—

1866 June......	331		1873 December......	308
1867 ,,	328		1874 ,,	327
1868 ,,	330		1875 ,,	358
1869 ,,	341		1876 ,,	398
1870 ,,	340		1877 ,,	417
1871 ,,	314		1878 ,,	425
1872 ,,	309		1879 ,,	473

A comparison between the Balance Sheets of this and the previous year shows the great advance in its finances made by the Society during the last 12 months. In 1878, the total receipts were £618, and the expenditure nearly £629, showing an adverse balance of nearly £11, whilst in 1879 the receipts have been £799, against an expenditure of £622, giving a balance in favour of the Society of £177. The receipts may be briefly summarised as follows:—Dividends £41 9s. 10d.; grants from the Meteorological Office, including £25 towards the inspection expenses, £131 12s.; subscriptions £357 14s.; entrance fees £80 4s.; life composition fees £144; sale of publications £39 14s. 11d., and £4 12s. allowance for extra printing, &c. The expenses may be grouped as follows:—Journal, £196 7s. 11d.; general printing, books, and bookbinding, £49 5s. 11d.; salaries, £190 10s.; office expenses, for rent, postage, coals, refreshments, petty expenses, £92 5s. 7d., and for alterations, repairs, and furniture, £50 15s. 9d., making a total under this heading of £143 1s. 4d. The inspection of stations, and purchase of instruments cost £42 14s. 3d. The sum of £100 has been invested in New Three per Cents. The following brief summary shows clearly the receipts from subscriptions, entrance fees, and life compositions in 1878 and 1879:—

	1878.			1879.		
Subscriptions......	£316	18	0	£357	14	0
Entrance Fees ...	37	1	0	80	4	0
Life Compositions	36	0	0	144	0	0
	£389	19	0	£581	18	0

As compared with 1878, the cost of printing in 1879 was nearly £40, and of illustrations £24 in excess, making a greater cost for the Journal of nearly £64. The sale of publications in 1879 produced £39 15s., being £7 11s. above that in 1878, whilst the ordinary office expenses and the salaries were nearly the same. The expenditure for inspection of stations was about £20 less than in 1878, but will probably be somewhat more in 1880, in consequence of the establishment of new Climatological Stations.

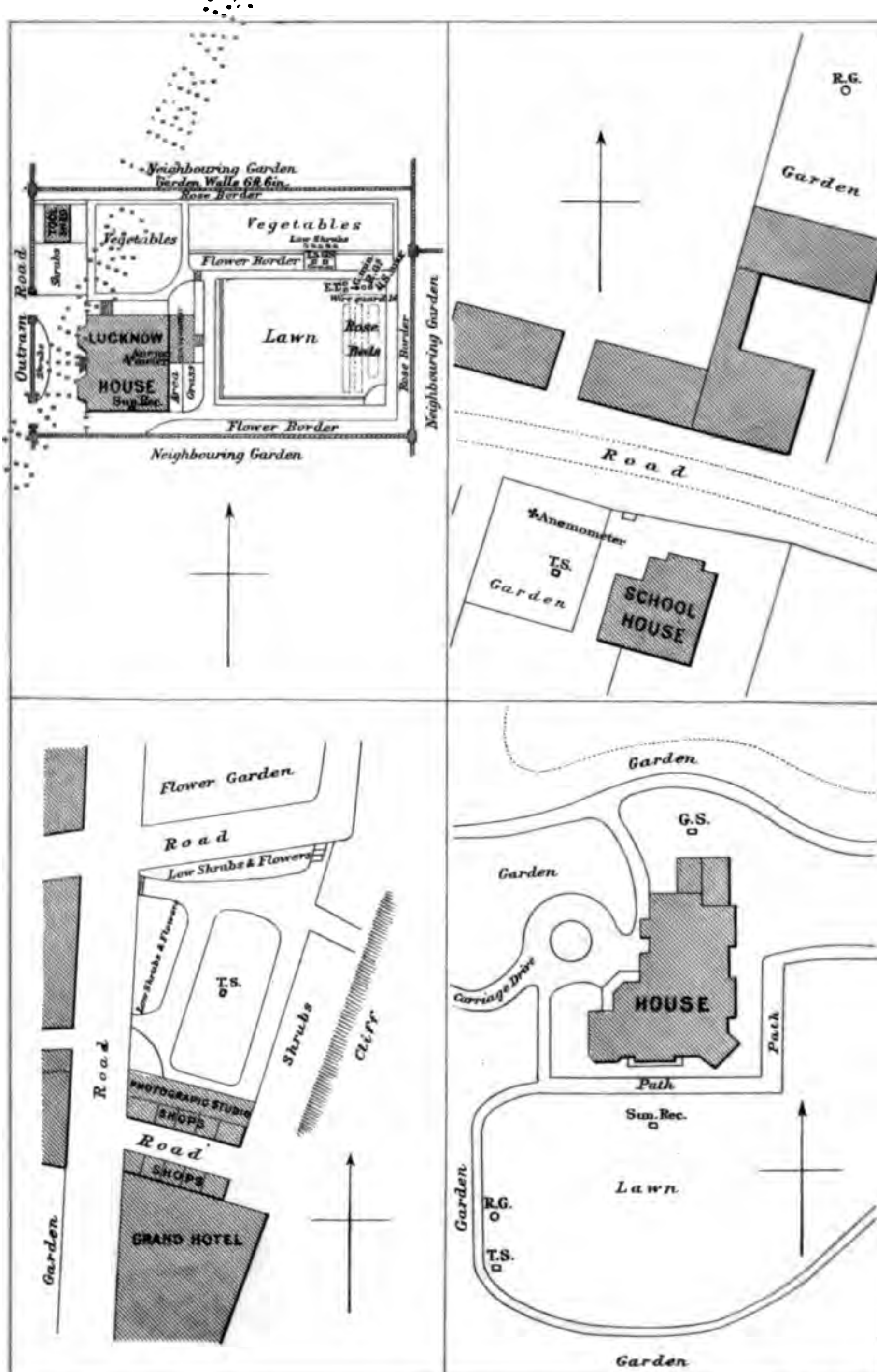
APPENDIX I.

Report of the Assistant-Secretary on the Inspection of the Stations. (Plates IV.-V.)

Croydon, *April 30th.*—Mr. Mawley being very desirous of having his observations published by the Society, and having undertaken to contribute


STATIONS
OF THE
METEOROLOGICAL SOCIETY
1880.
Second Order Stations.
Climatological Stations.
Stapleton
Scaleby
Alston
Cockermouth
Scarborough
Blackpool
Blackburn
Wakefield
Kelstern
Buxton
Hodsock
Colwyn
Llandudno
Chester
Oakamoor
Cheadle
Farley
Mansfield
Belper
Leaton
Loughborough
Cromer
Hillington
Somerleyton
Lowestoft
Church Stoke
Kenilworth
Burghill
Aspley Guise
Throcking
Ross
Cheltenham
Carmarthen
Strathfield Turgis
Watford
Isleworth
Norwood
Croydon
Cardiff
Marlborough
Ramsgate
Downside
Harestock
Swarraton
Tunbridge
Ilfracombe
Southampton
Cranleigh
Tunbridge Wells
Lymington
Portsmouth
Worthing
Eastbourne
Dartmoor
Sidmouth
Teignmouth
Babbacombe
Torquay
Maker
South Bourne
Ventnor
Guernsey
West 2° Long.
East 1° Long.
Malby & Sons, Lith.

ADDISCOMBE, CROYDON. DARTMOOR.



Maltby & Sons Lith.

SCARBOROUGH. SOUTHBOURNE ON SEA.

SCALE.

towards the cost of the reduction and printing, the Council accepted his offer to supply observations from his station at Addiscombe. The instruments are placed in a large open garden, and are fully exposed. The district is nearly level, the ground gently sloping to the north, with a porous sandy soil.

DARTMOOR, *April 3rd.*—On the removal of Dr. Power to Portsmouth, arrangements were made with Mr. W. H. Tooker, of the Post Office, Prince Town, by which he undertook to carry on the observations at this, the highest of the Society's stations. New instruments were sent down, and these were mounted on May 1st in a garden adjoining the Prison Officers' School.

SCARBOROUGH, *August 1st.*—The Meteorological Office having given up Scarborough as one of its telegraphic reporting stations, the instruments were purchased by the Town Council, and Mr. Shaw continued as observer. The thermometer stand is placed on a level grass-plot in a garden on the east side of which is a steep cliff, and about 500 feet from the sea-shore. The site is quite clear and open from the N to the SE, but on the other quarters houses rise to an angle of 30°. The rain gauge is in a market garden near the railway station.

SOUTH-BOURNE-ON-SEA, *May 26th.*—This station is about 3¼ miles east of Bournemouth, and 1½ mile south-west of Christchurch. The situation is very open and exposed, being on a level plateau about 400 yards from the sea cliffs. There are no trees within a quarter of a mile of the house. In addition to the regular instruments, Dr. Compton has a sunshine recorder for registering the amount of sunshine.

APPENDIX II.

LIST OF BOOKS PURCHASED.

BRITISH ASSOCIATION.—Reports, 1849, 1850, 1852, 1855, 1857-61. 8vo. (1850-62.)

DUDLEY OBSERVATORY.—Annals, Vol. II., 1862-71. 8vo. (1871.)

FLAMMARION, C.—The Atmosphere. Edited by J. Glaisher, F.R.S. 8vo. (1873.)

HOPKINS, T.—On Winds and Storms. 8vo. (1860.)

HOWARD, L., F.R.S.—Seven Lectures on Meteorology. 12mo. (1837.)

MAKERSTOUN.—Magnetical and Meteorological Observations, 1847-55. Edited by B. Stewart, M.A. 4to. (1860.)

SCHMID, Dr. E. E.—Lehrbuch der Meteorologie, nebst einem Atlas von ein-und-zwanzig Tafeln. 8vo. (1860.)

STEINMETZ, A.—A Manual of Weathercasts. 8vo. (1866.)

TAYLOR, J.—The Complete Weather Guide. 8vo. (1813.)

APPEN-

Abstract of Receipts and Expenditure

Receipts.

	£	s.	d.	£	s.	d.
Balance from last year				73	0	8
Dividend on £800 M. S. and L. R. 4½ Debenture Stock	35	5	0			
Do. £212 5s. New 3 per Cents.	6	4	10			
				41	9	10
Meteorological Office:—						
Copies of Monthly Returns from 14 Stations	100	0	0			
Do. Annual " 1 "	2	10	0			
Grant towards Inspection Expenses	25	0	0			
Cost of Printing Paper on Meteorology of Natal	4	2	0			
				131	12	0
Subscriptions for 1876	5	1	0			
Do. for 1877	18	1	0			
Do. for 1878	39	12	0			
Do. for 1879	290	0	0			
Do. for 1880	5	0	0			
Entrance Fees	80	4	0			
Life Compositions	144	0	0			
				581	18	0
Kew Committee—Half Cost of Printing Plate 25				2	10	0
Mr. E. Mawley—Publication of Observations				2	2	0
Sale of Publications, &c.				39	14	11
				£872	7	5

DIX III.

for the Year ending December 31st, 1879.

Expenditure.

	£ s. d.	£ s. d.
ournal—		
Printing Nos. 29—32	141 12 5	
Illustrations	34 12 6	
Authors' Copies	12 11 0	
Registrar-General's Report	7 12 0	
		196 7 11
rinting, &c.—		
General Printing	10 7 6	
List of Fellows	10 0 0	
Climatological Forms	4 1 3	
Stationery	7 0 10	
Books and Bookbinding	17 16 4	
		49 5 11
alaries—		
Assistant-Secretary	140 0 0	
Do. Gratuity	5 0 0	
Computers	45 10 0	
		190 10 0
ffice Expenses, &c.—		
Rent and Housekeeper	41 7 3	
Repairs, Alterations and Furniture	50 15 9	
Postage, &c.	33 7 7	
Coals, Insurance, &c.	1 18 0	
Refreshments	10 19 6	
Parcels and Petty Expenses	4 11 3	
Commission on Irish Cheques	0 2 0	
		143 1 4
bservations—		
Inspection of Stations	33 7 3	
Dartmoor—Instruments and Observations	9 7 0	
		42 14 3
tock—		
Purchase of £103 15s. 3d. New 3 per Cents.		100 0 0
		721 19 5
alance—		
In hands of Bank of England	141 16 11	
Do. Assistant-Secretary	8 11 1	
		150 8 0
		£872 7 5

HENRY PERIGAL, *Treasurer.*

Examined and found correct,

JOHN SANFORD DYASON, } *Auditors.*
CHARLES HARDING, }

anuary 5th, 1880.

APPENDIX III.—*Continued.*

Abstract of Assets and Liabilities on January 1st, 1880.

Liabilities.

	£	s.	d.
To Subscriptions for 1880 paid in advance	5	0	0
,, Excess* of Assets over Liabilities	1571	17	10
	£1576	17	10

Assets.

	£	s.	d.	£	s.	d.
By Society's Money invested in New 3 per Cents., £316 0s. 3d., at 97½	308	2	0			
,, Society's Money invested in M.S. and L.R. 4½ Debenture Stock, £800, at 117	936	0	0			
				1244	2	0
,, Subscriptions unpaid, estimated at	60	0	0			
,, Entrance Fees	6	0	0			
,, Dividend on £800 M. S. and L. R. 4½ Debenture Stock	17	12	6			
,, Meteorological Office—Weekly Returns	3	15	4			
				87	7	10
,, Furniture, Fittings, &c.	40	0	0			
,, Instruments	55	0	0			
				95	0	0
,, Cash in hands of Bank of England	141	16	11			
,, Do. Assistant Secretary	8	11	1			
				150	8	0
				£1576	17	10

* This excess is exclusive of the value of the Library and Stock of Publications.

JOHN SANFORD DYASON, } *Auditors.*
CHARLES HARDING,

January 5th, 1880.

APPENDIX IV.

Obituary Notices of Deceased Fellows.

Charles Brooke, F.R.S., only son of Henry James Brooke, F.R.S., was born in London on June 30th, 1804. He was educated first at Chiswick, under Dr. Turner, afterwards at Rugby, then at St. John's College, Cambridge, which he left as a Wrangler. He was a student of the Windmill Street School of Medicine, and also of St. Bartholomew's; and for a long time was Surgeon of Westminster Hospital.

He invented the photographic self-registering magnetic and meteorological apparatus, which obtained the premium offered by the Government for the best method of automatic registration: and which was at once adopted by, and continues in use at, the Royal Observatory, Greenwich; and was subsequently employed at the observatories of Paris, Cambridge, U.S., and Toronto.

He was the author, in its present form, of the "Elements of Natural Philosophy," one of the best of Messrs. Churchill's series of Manuals. The work was originally written by Dr. Golding Bird, but, after his death, owing to the advance in physical science, it became necessary to rewrite it, and the numerous editions that have since been called for testify to its continued popularity.

Mr. Brooke was very fond of microscopic investigations, and invented several optical and mechanical improvements in the microscope; the "double nose piece," an arrangement for carrying two object glasses, being the one which is most likely to be remembered.

He was elected a Fellow of the Royal Society in 1847, and of the Royal Microscopical Society in 1851. He was President of the latter Society on two occasions, viz. in 1862-4, and in 1873-4.

He joined the Meteorological Society in the first year of its existence, served on the Council from 1852 to 1879; held the office of President from 1865 to 1867, and that of Secretary from 1867 to 1873.

Mr. Brooke was the kindest and most genial of men, unassuming and modest, and ever ready to aid others by suggestions or advice; which his original and inventive mind generally made of the greatest value.

He died at Weymouth on the 17th May, 1879, in the seventy-fifth year of his age. [C. K. B.]

In Heinrich Wilhelm Dove, who died at Berlin on April 4th, our science has lost its most eminent follower. He was born at Liegnitz in 1803, and at the early age of 26 was summoned as Professor of Physics to the University of Berlin.

From that date for the period of half a century his work was unremitting, and its results remain as solid stones in the edifice of human knowledge.

His special subjects were Optics, Electricity, and, above all, Meteorology.

The number of papers standing to his name in the Royal Society Catalogue is no less than 234; and we may say of him "nihil tetigit quod non ornavit."

If the original idea of Isothermal Charts was due to Alexander von Humboldt, the credit of working them out is Dove's own.

One word must, however, be said for Dase, his famous calculating assistant, without whose marvellous powers the enormous mass of figures could never have been dealt with in the time actually employed in their discussion. [R. H. S.]

Dr. JOHN VON LAMONT was a countryman of our own. He was born in 1805 in Braemar, and belonging to a Roman Catholic family, he went at the age of 12 to the Scotch College of the Benedictines at Ratisbon. Ten years later he went to Munich, and stayed there for the rest of his life, firstly, as Assistant at, and then, since 1833, as Director of the Observatory. He died on the 6th of August. His non-astronomical investigations were more in the line of terrestrial magnetism than of meteorology, but in the latter branch he made several most important contributions to our knowledge. The total list of his Papers in the Royal Society Catalogue amounts to 107. [R. H. S.]

Cavaliere ENRICO ANGELO LUDOVICO NEGRETTI was born at Como, in Lombardy, November 13th, 1818. He came to London in 1830, and was apprenticed to Cæsar Tagliabue, the optician. He soon became famous as a glass-blower, and maintained his skill in that art to the last. Whenever, in his later years, a new idea crossed his mind, either in the direction of improving or of inventing some philosophical instrument, he would work at the bench till he had succeeded, not only to his own satisfaction, but until he had convinced himself that his skilled workmen were thoroughly competent to master the details of the construction. Indeed his skill as a glass-blower was so well known to the workmen of the trade, that he was called by them *El gonfia*, the glass-blower. Soon after his apprenticeship he entered into what proved a life-long partnership with his fellow-apprentice and intimate friend Joseph Zambra, as philosophical instrument makers. The Universal Exhibition of 1851 brought this firm prominently before the public for the novelty and perfection of their scientific instruments, more especially meteorological. In every succeeding exhibition, both in this country and abroad, the firm has maintained its high character and obtained medals and diplomas of the highest class awarded. These great results were due to a keen intelligence, inventive faculty, indomitable perseverance, allied to uprightness of character and exceptional mercantile abilities.

Mr. Negretti's natural energy and geniality of disposition marked him out as the friendly guide of the Italians settled in London. Hence, in 1865, he felt himself called upon to interfere on behalf of the unfortunate Polizzoni, who had been condemned to the gallows for a murder of which he was perfectly innocent; and, almost single-handed, he succeeded in averting this miscarriage of justice, and in convicting the real culprit. Few men would have undergone the ordeal of anxiety and the arduous exertions necessary to

achieve such a noble deed. The public recognition of his services was unanimous, and in 1869 the King of Italy, Victor Emmanuel, conferred on him spontaneously the honour of Knighthood of the Order of San Maurizio, which he properly prized, though he was too modest to make any public boast of it. At a later period he was the first to take steps to bring the swindlers in the "great turf frauds" to justice. By his prompt action considerable sums of money, in Post Office orders and coin, sent from Italy, in consequence of the advertisements which they had put in the Italian newspapers, were stopped and returned to the senders. Guided by a sense of duty, he was ever ready to aid in any good and beneficent work; and thus he earned the unbounded gratitude of his countrymen, who looked to him for assistance and advice in whatever misfortunes and difficulties befell them here in London. Among his friends were men of science, politicians, and men of letters; and each class could find a charm in his society, for his attainments were of no mean order. Speaking fluently Italian, English and French, he had a knowledge of other languages, and a varied fund of general information, while in his own business as an optician he was *facile princeps*.

When General Garibaldi visited England in 1854, he was the guest of Mr. Negretti, who was then living at Holloway. In 1864, when the General revisited London, after the conquest of the Two Sicilies, Mr. Negretti was his almost constant companion in his capacity of chief of the Italian Reception Committee.

In 1855 Mr. Negretti became a Fellow of the Meteorological Society, and continued to the last to take an interest in its work, occasionally attending the meetings, and from time to time bringing his inventions relating to meteorology before the Fellows. These inventions were always described as the joint productions of Messrs. Negretti and Zambra, and therefore it is not possible to divide their merit. It will accordingly suffice to mention some of them here.

Enamelling Thermometer Tubes.—This invention was not patented, as it was not deemed at the time of much importance, though it has come into general use. As the white enamel at the back of the tube enables the finest thread of mercury to be easily visible, thermometers can thus be made of any degree of sensitiveness. Delicate thermometers, such as the *clinical*, could not be constructed without the enamelling.

Maximum Thermometer, invented in 1851, was described in the Report of the Meteorological Society 1852-3.

Minimum Thermometer, mercurial with steel indices, invented in 1853, was described in the Report of the Meteorological Society 1855-6.

The Double-bulb Six's Thermometer, invented in 1857, enabled Six's instrument to be used for taking temperature observations of the deepest seas unaffected by the pressure of the water:—*Vide* First Number of Meteorological Papers, by Admiral FitzRoy; also Quarterly Journal of the Meteorological Society, Vol. I.

"*Gun*" *Barometer*, constructed in 1860, for use in the Royal Navy: *vide* Proc. Met. Soc. Vol. I. p. 70.

Pocket Aneroid, a reduction of the ordinary size aneroid to meet the requirements of Admiral FitzRoy, afterwards still further reduced to the "watch" size; described in Proc. Met. Soc. Vol. I. pp. 84, 155.

Minimum Thermometer, mercurial with platinum stop, invented in 1861; *vide* Proc. Met. Soc. Vol. I. p. 212.

New Travelling and Standard Barometer, described in Proc. Met. Soc. Vol. I. p. 118.

Maximum Thermometer, for use at sea, in deep wells, &c., invented in 1874.

Recording Thermometer, invented in 1874, for deep-sea observations, and self-registering observations in connection with clock-work, described in Quar. Jour. Met. Soc. Vol. II. pp. 188 and 292, also Vol. III. p. 365.

Standard Deep-sea Thermometer, with reversing float, invented in 1878, which has been applied also for recording purposes in connection with clock-work.

At the suggestion of the writer of these lines, Mr. Negretti had contemplated the invention of a maximum thermometer for temperatures below the freezing-point of mercury, and he always maintained that he could accomplish the task. He was engaged experimentally on the subject at the time of his last illness. Meteorological subjects always had a fascination for him. He it was who devised the barometer diagrams for the *Daily Telegraph*, *Daily News*, and some other newspapers, which have certainly tended to popularise the study of weather changes from day to day.

Mr. Negretti had a residence at Como, and whenever he took a holiday it was to go to Italy. But in 1878 he was induced to visit the Argentine Republic, partly on a business mission, while it was thought that perhaps the voyage might do him good. He went up the country as far as the observatory at Cordova. He worked and exposed himself too much, and he returned with visibly impaired health. Being of a restless energy, travel and exposure proved too trying to the constitution at his age. Gradually his friends saw a deeper and deeper encroachment upon his fine and stately physique which the wear and tear of life was effecting, and advised care and rest. But rest was what he least desired, and it was some months before he yielded to the advice of his physician and abstained from business. An affection of the lungs developed itself, and while for a long time it was hoped that his naturally strong constitution would carry him through, it was to be otherwise. He died of pleuropneumonia, at the age of 61 years, on September 24th, 1879, at his residence at Cricklewood. On October 1st he was buried in Highgate Cemetery. He married in 1845 Miss Mary Peet. His widow survives him, and he leaves a son, who succeeds him in the business, and two daughters.

[R. S.]

THOMAS SOPWITH, M.A., F.R.S., who was President of the Meteorological Society during the years 1859-61, was born at Newcastle-on-Tyne on January 3rd, 1803.

He commenced life as a Surveyor and Civil and Mining Engineer at an

early age, and pursued the active exercise of his profession for a period of 50 years with success, during which he was engaged on many important mining surveys and cases of reference; he also acted for some years as Commissioner for the Crown under the "Forest of Dean Mining Act," and was consulted by the Belgian Government on the development of the railway system of that country.

Early in life he evinced a taste for literary and scientific pursuits, which he found time to cultivate in the midst of an active business career; and the results of his studies are seen in a number of books and pamphlets which he published, and in numerous papers read before the various learned societies, of most of which he was a member. He was thus brought into contact and close personal intercourse with many of the leading minds of the day—Sir Roderick Murchison, Professor Phillips, Sir F. Chantrey, George Stephenson and his son Robert, Mary Somerville, Babbage, Dr. Buckland and James Glaisher being among his valued friends.

He took a deep interest in the moral and social welfare of the workmen and their families placed under his charge, and his efforts in the cause of practical education were recognised by the University of Durham conferring upon him the degree of M.A.

He exhibited an active interest in the subject of Meteorology; at Allenheads and Bywell, in Northumberland, where he was professionally engaged for many years, he kept regular meteorological observations, which were transmitted to the Registrar-General, and were mainly interesting on account of the difference of elevation, Allenheads being about 1,300 feet higher than Bywell.

In conjunction with the late Duke of Northumberland, he interested himself in the placing of good meteorological instruments at the several fishing villages on the coast of Northumberland, for the keeping of correct observations where a knowledge of the weather is so important to the lives and property of the fishing population. In 1838 he contributed to the Transactions of the Royal Cornwall Polytechnic Society a paper on 'An Easy Means of recording the State of the Weather,' and in 1859 and 1861 he read papers before this Society 'On the practical importance of Meteorology,' and 'On Barometer Indications.'

Mr. Sopwith was fond of travelling, and published the results of his observations in various works, printed chiefly for private circulation: among others may be named 'Notes on Egypt,' 'A Visit to France and Spain,' 'Three Weeks in Central Europe,' and 'A Tour in Switzerland.'

He was a man of great industry, extremely methodical in his habits, a ready and precise writer, a genial companion, and a kind friend.

He died in London on January 16th, 1879. [T. S.]

John Waterhouse, F.R.S., was born at Halifax, Yorkshire, on August 3rd, 1806. Very early in life he evinced a decided taste for scientific studies, and the training which he received at school only served to increase this preference, and enabled him to obtain a sufficient knowledge of mathematics,

which he turned to good account in after years in the various branches of physical research to which he gave attention.

A certain weakness of constitution, which prevented him in his youth from undergoing great physical exertion, only seemed to stimulate his mental activity; and when, in search of change of climate with a view to invigorated health, he undertook a voyage round the world, the training which he had received, and the bent of his mind enabled him to record his observations in a journal which is a storehouse of scientific facts and notices, and which, had not his modesty shrunk from having it printed, would have proved the record of a "scientific expedition" when such journeys were far less numerous and attended by far greater inconveniences than at present. During this voyage his love of nature and the wide range of his scientific tastes acquired an increased stimulus, and when he returned home his experience in observation and his knowledge of natural phenomena in different parts of the world enabled him to enter with renewed pleasure into the less active study of the physical sciences.

He established an astronomical and meteorological observatory, and in connection with the latter, published a few years ago a work on the "Meteorology of Halifax."

Practical botany also engaged his attention, and his gardens were distinguished throughout the neighbourhood for the rich variety of their contents, of which he was justly proud.

His favourite studies were astronomy, geology, electricity and light, and in connection with the latter he was identified with the early progress of photography, and with the discovery by the Rev. J. B. Reade, F.R.S., of the method of taking portraits, first upon leather and afterwards upon paper, instead of upon silver plates or glass, and also with the chemical means of giving permanence to such images.

He was specially interested in the progress of microscopy, and was himself both a skilful observer and an adept in those manipulations which are necessary in the preparation of objects for examination.

He was also identified with various movements which had for their object the spread of scientific knowledge; and, in connection with the local Literary and Philosophical Society (of which he was one of the founders, and for many years the President), he lectured on more than one occasion on various scientific subjects. He also enriched the museum with many choice objects of natural history, collected during his travels.

He was also connected with the Mechanics' Institute during its early years, and was active as a magistrate, being for many years Chairman of the County Bench at Halifax, and a Deputy Lieutenant for the West Riding.

He died on February 12th, 1879, in the 72nd year of his age.

He was a Fellow of the Royal Society, of the Royal Astronomical Society, and of several other Societies.

SAMUEL CHARLES WHITBREAD, F.R.S., second son of Samuel Whitbread, M.P., was born on February 16th, 1796. He was one of the founders of this

Society in 1850, was its first President, and continued on its Council till 1873. He took a great interest in meteorology, and erected an observatory at his residence at Cardington, where meteorological and astronomical observations are still carried on. He was elected a Fellow of the Royal Society on June 1st, 1854. He was also a Fellow of the Royal Astronomical Society, and held the office of Treasurer from 1857 to 1878. He died in London, on May 27th, 1879.

APPENDIX V.

Reports of Observatories, &c.

The Meteorological Office. Professor H. J. S. Smith, M.A., F.R.S., Chairman of the Council: Robert H. Scott, M.A., F.R.S., Secretary.

Marine Meteorology.—The extraction from the logs of data for the district lying near the Cape of Good Hope having been completed, the time of the staff has been occupied during the year with the discussion of the materials collected.

In the Report of the Council for 1878, which has just appeared, a notice will be found of a new mode of drawing wind roses, which has been devised by Mr. F. Galton. This method has been adopted, and wind charts based upon it are in an advanced stage of completion.

The other elements which have been treated up to the present time have been Barometrical Pressure, Temperature (Air and Sea Surface), and Ocean Currents. As regards the Pressure and Temperature the Council propose to exhibit on the Charts not merely the mean values obtained from the observations, but also the range, so as to show the amount of variability which may be reasonably anticipated.

The work of copying data from the Indian Seas, which had been undertaken for the India Office, has been completed, so that a large portion of the stores of undiscussed material in the Meteorological Office has been rendered accessible to Mr. Blanford for his investigations.

A discussion has been undertaken of observations made in the Arctic Regions, chiefly of those accumulated during the search for Sir J. Franklin. The first part of this discussion, referring to land stations, has been published. The second part, referring to ships wintering in the Arctic Regions, is in the press and will shortly appear; and the third part, referring to the summer time, when the sea was navigable and ships were under sail, is now in preparation. The area covered by the inquiry extends from the meridian of Cape Farewell (43°54′ W) to that of 120° W, and from the parallel of 60° to about 80° N.

A paper by the Rev. S. J. Perry, F.R.S., on the results of the three British Expeditions to Kerguelen Island, those of Sir J. C. Ross, of H.M.S. 'Challenger,' and of the 'Transit of Venus' party, has been published.

Weather Telegraphy.—The chief changes as regards the stations have only taken effect at the close of the year 1879. These have consisted, 1st, in the establishment of a station at Parsonstown, in the centre of Ireland, instead of Kingstown, which has been suppressed; and 2nd, in the organisation of a reporting station at Hawes Junction, near Settle, at a height of more than 1,000 ft. above sea-level, being the first approach to an elevated telegraphic reporting station in these Islands.

The arrangements for the supply of information for 6 p.m. to the 'Times' at the expense of that Journal have been maintained, but modified inasmuch as the 'Daily News' and 'Standard' have, during a part of the past year, participated with the 'Times' in this arrangement.

The most important practical advance which has taken place in this branch of the Office has been the issue of regular forecasts for the various districts of the United Kingdom. This was set on foot in April 1879, and at the same time

facilities were afforded to the public by the Post Office authorities for the receipts by prepayment, of telegraphic replies to weather inquiries. Of these latter arrangements considerable use has been made, and the number of subscribers for the printed forecasts is large. The checking of the forecasts for the current year is in progress, but figures showing the result have not as yet been published.

In the month of June the Council decided upon sending forecasts gratis, during the hay harvest, to about 25 gentlemen recommended by the Councils of the Chief Agricultural Societies of the United Kingdom, on the condition that they would send to the Office their opinions on the value of the forecasts for their respective districts. The experiment was received with great favour, and several of the gentlemen took special measures to disseminate the forecasts when received.

The following table, exclusively drawn up from these opinions, has already appeared in the newspapers. The result must be regarded as fairly encouraging.

SUMMARY OF RESULTS.

Districts.	Names of Stations.	Percentages. Complete Success.	Partial Success.	Partial Failure.	Total Failure.	Total percentage of Success.
Scotland, N......	Golspie	47	34	11	8	81
„ E......	Longniddry, Glamis, Dunkeld, and Edinburgh, (2)	44	31	16	9	75
England, NE	Morpeth, Darlington, Leyburn and Ulceby	51	30	11	8	81
„ E......	Ipswich, Harpenden and Romford	47	23	20	10	70
Midland Counties	Cirencester, Oxford and Aylesbury	65	18	13	4	83
England, S	Maidstone and Downton	55	33	12	0	88
Scotland, W.	Islay and Lochgilphead	44	23	14	19	67
England, NW	Bolton, Prescot and Warrington	51	23	18	8	74
„ SW	Clifton, Falfield and Glastonbury	51	21	17	11	72
Ireland, N.	Ballinrobe and Oldcastle	43	37	9	11	80
„ S	New Ross	27	32	26	15	59
	Mean for all districts	48	28	15	9	76

The lowest percentage of success in Great Britain was attained in "Scotland, W," but it may be remarked that, of the 2 observers in this district, only 1 has sent in anything like a detailed return, and the values for the second station have, therefore, been estimated merely from the opinions of the recipient, as expressed by letter. It was, moreover, scarcely likely that the forecasts for such a region would prove very accurate.

"England, E," shows the next lowest percentage, but the values for this district have been considerably modified by the observations furnished from Rothamsted, where the local character of the weather was the subject of special remark by the observer, Dr. Gilbert.

The low percentage of "complete success" in "Scotland, E," was due to the failure of those portions of the forecasts which related to the direction of the wind rather than those which related to the weather in its more generally accepted sense.

The highest percentage of success was in "England, S," for which district both the observers reported an entire absence of "total failures."

The publication of the Weekly Weather Report has been continued, and the volume for 1879 contains, as an Introduction, the values of the Mean Temperature and Rainfall for the decade 1866-75 and for the last 4 years for each of the 11 districts into which the United Kingdom has been divided.

These figures are of course merely a general approximation to the truth, as

the number of stations from which they have been compiled is small, and the observations have not, in all cases, been continuous.

Land Meteorology of the British Islands.—The returns from the Stations of the Second Order for 1878 have been completed, and will shortly appear as a separate publication.

The plates for the Quarterly Weather Report for the years 1876 and 1879 are in an advanced stage of preparation, but the precise form of the text for the years subsequent to 1875, has not yet been decided upon.

The Harmonic Analyser has been completed and is now at the Office. It contains discs, giving the mean value and the periodic terms of the first 3 orders of Bessel's Formula. Preliminary trials with the instrument are in progress, and have so far given satisfactory results.

The Council at the close of the year issued to 30 different Stations Sunshine Recorders, on the principle proposed by Mr. J. F. Campbell, of Islay, the arrangement for retaining the recording cards in an approximately true position being on a pattern designed by Prof. Stokes. By the kind assistance of the Council of the Meteorological Society, 4 of these have been supplied to as many of the Society's Stations, viz. at Churchstoke, Hillington, Kelstern and Llandudno. It is to be hoped that satisfactory results may be derived from the simultaneous observations of sunshine on a uniform plan at so many stations.

ROYAL OBSERVATORY, GREENWICH.—Sir G. B. Airy, K.C.B., F.R.S., Astronomer Royal.—No change of any kind has been made during the year 1879 either in the instrumental equipment of the Meteorological Department or in the subjects of observation carried on therein, the various automatic records and necessary eye observations being maintained on the same general plan as before.

The observations of the temperature of the water of the Thames are for the present suspended; the Police ship 'Royalist,' to which the thermometers were attached, was injured by a steamer having come into collision with her on the night of October 18th last, since which time the ship has been in dock for repair.

Since the substitution of the sulphuric acid insulators for the ebonite pillars, for insulation of the water cistern of the Thomson electrometer (as mentioned in last year's report), the insulation appears to have been quite satisfactory.

Meteorological Reports are sent daily to the Meteorological Office, to Paris, and to various newspapers; weekly (a very full report) to the Registrar General, and half-monthly to General Myer (through the Meteorological Office). Other periodical reports of a minor character are also made, besides which meteorological information of various kinds is from time to time communicated from our records to persons making special application.

The publication of a daily record of the amount of sunshine, as given by Campbell's instrument, commenced in the year 1876, and since continuously maintained, has excited considerable interest. Numerous inquiries have been addressed to us in regard to the instrument, which appears to be now coming into much more general use. The Right Hon. H. Brand, Speaker of the House of Commons, set up, at the beginning of the year 1879, an instrument precisely similar to that at Greenwich, and the comparison of the results given by the 2 instruments (at Greenwich and Glynde) has proved very interesting.

The annual volume, that for 1877, shortly to be distributed, contains meteorological results as regards atmospheric pressure, and air and evaporation temperatures and humidity, deduced from the photographs, instead of employing, as in former years, those derived from eye observations.—*Feb. 7th*, 1880.

ROYAL OBSERVATORY, EDINBURGH. Professor C. Piazzi Smyth, F.R.S.E., Astronomer Royal for Scotland.—During the last year the observations at 55 stations of the Scottish Meteorological Society have been computed here, discussed, and the returns sent to the Registrar-General of Scotland, and printed in his Monthly and Quarterly Reports.

The special, but small, Meteorological Journal for Observatory purposes has been duly kept up; and some remarkable confirmations obtained of the trust-

worthy character of the Spectroscopic "Rain-band," as a forerunner of some of the chief rain-falls of the last very rainy summer. The notations also of mean cloudiness of the sky have been recently used by Sir Robert Christison, M.D., before the Edinburgh Botanical Society, in explanation of the small amount of woody matter added by trees to their trunk's girth during the same period, though their green leafage was large.

In the month of June, the Long Rock Thermometers, so calamitously destroyed in 1876, were successfully replaced by Messrs Adie and Son, and are being now observed regularly in the accustomed manner of old. They are, therefore, quite ready to chronicle the great wave of solar heat expected during the present year, on the strength of their former records that 3 such waves, at nearly 11 years interval, have occurred during the 40 years that the observations have lasted.

In the 13th volume of the Edinburgh Observations, published in 1872, the coming wave of solar heat was concluded to be "in or about 1880;" but in the 14th volume, published in 1877, I altered that to 1879·6 ; a decided error, but caused, as may now be seen very plainly on the Thermometer plate of projections, by my having been furnished with an erroneous date for the last Sun-spot minimum. This had been given to me as 1877·3 ; but continued observations have shown that it did not occur until 1879·3. Wherefore, modifying the causes accordingly, the date of the long expected wave of extra solar heat comes out 1880·6.—*Jan. 8th*, 1880.

KEW OBSERVATORY. G. M. Whipple, B.Sc., F.R.A.S., Superintendent.—The several self-recording instruments for the continuous registration of atmospheric pressure, temperature, humidity, wind (direction and velocity), and rain have been maintained in regular operation throughout the past year. The standard eye observations made 5 times daily, for the control of the automatic records, have been duly registered, together with the daily observations at 0.45 p.m. in connection with the Washington synchronous system. An additional daily observation has been made since July 1st at 6.45 p.m. to be used in a second synchronous system organised by M. Mascart, Directeur du Bureau Central Météorologique, Paris.

The tabulation of the meteorological traces has been regularly carried on, and copies of these, as well as of the eye observations, with notes of weather and cloud, have been transmitted weekly to the Meteorological Office.

With the concurrence of the Meteorological Council, weekly abstracts of the Meteorological results have been regularly forwarded to and published by the 'Times,'* 'Illustrated London News,' 'Mid-Surrey Times,' and 'Torquay Directory' newspapers.

The Electrograph has been in continuous action through the year, although it was found necessary in August to dismount and clean it, in order to restore the power of keeping a full charge of electricity, which had become somewhat impaired. On consideration it was deemed inadvisable to alter the bifilar suspension, but the Mascart insulating stands were fixed for the support of the water-dropping cistern, and the action of the instrument has been greatly improved by their adoption, so that strong charges of electricity are now registered even in the dampest weather.

The 4 solar-radiation thermometers and 1 terrestrial-radiation were observed daily until August 3rd, when all, with the exception of one black bulb thermometer, were completely destroyed by the great hailstorm which occurred on that date. Since then only one, the remaining black bulb, and a new terrestrial-radiation thermometer have been daily observed.

The Campbell sunshine recorder continues in action, and the improved form of the instrument, giving a separate record for every day of the duration of sunshine, has been regularly worked thoughout the year, and its curves tabulated. Two papers based upon these records have been published in the Quarterly Journal. (Vol. V., pp. 142 and 213.) Various experiments have been made with the sun-

* A detailed investigation was made in the month of January into the accuracy of the weekly Meteorological records published in 'The Times.' The result on the whole was very favourable, the principal difference being found in the rainfall, which is usually given in excess of the true amount.

shine recorder from time to time with the view of improving its efficiency, and new instruments with certain modifications of the Kew pattern have been submitted for approval by Messrs. Beck and Mr. Casella.

The numerous adjustments and electrical contacts, altogether 190 in number, of the Wind Component Integrator, render it particularly subject to derangement in this country, the damp atmosphere causing frequent failures in the electrical actions, and the high winds constantly shaking the screws loose. The continual necessity for readjustment causing a greater demand upon the time of the Observatory staff than the Committee feel themselves justified in bestowing upon it, they have reluctantly decided upon dismounting it, and it will shortly be returned to South Kensington, to be again set up in the Loan Collection of scientific apparatus.

At the request of the Meteorological Council the Photo-nephoscope was, in March, placed in the hands of Captain Abney, R.E., that gentleman having kindly offered to make some experiments with it.

Experiments have been for some time in progress at the Observatory with the view of determining the relative merits of different patterns of thermometer screens. For this purpose there have been erected on the lawn a Stevenson screen, of the ordinary pattern, and a large wooden cage, containing a Wild screen, of the pattern employed in Russia. Each of these screens contains a dry and a wet bulb thermometer, and a maximum and minimum, all of which are read daily at 9 a.m. and 9 p.m., their indications being compared with those of the thermograph at the same hours. A third portable metal screen, designed by Mr. De La Rue for use on shipboard, which contains a dry bulb thermometer only, is also carried out by the observer, and read at the same time as the fixed instruments. The cost of these experiments is borne by the Meteorological Council.

Mr. J. Jordan, having obtained a grant from the Government Fund of the Royal Society for the construction of a glycerine barometer, applied to the Committee for permission to erect it in the Observatory. This they willingly granted, and they also undertook to read it regularly for one year. It has accordingly been set up in the building, but owing to its great length, 30 feet, some difficulty was experienced in finding a suitable situation for it. Eventually it was decided to fix the cistern (which was first ascertained to be constructed of non-magnetic materials) in the magnetograph room, to lead the tube of composition metal up through the entrance hall, and to put up the upper part of glass, with the verniers and divided scales, in the north library in a convenient position for reading. It was successfully filled, by Mr. Jordan, with glycerine (coloured red), and has since its erection been read 5 times daily, simultaneously with the standard mercurial barometer.

Mr. F. Bogen has deposited 2 of the patent standard cistern siphon barometers, described by him in the 'Quarterly Journal,' Vol. V. p. 137, in the Observatory for comparison.

Mr. De La Rue has devised a small evaporation gauge, by means of which the water given off from a continually-wetted sheet of vegetable parchment is measured daily. 2 of these instruments are now at Kew, and their indications noted every day, at 10 a.m.

The Meteorological Council, in contemplation of the future use of Thomson's Harmonic Analyser, instructed the Superintendent to again test the anemograph designed by Mr. De La Rue, for the purpose of indicating at once, without replotting, the horizontal movement of the wind from hour to hour. The instrument, when tried at the Observatory in 1872, was found to be somewhat defective in its working, as, owing to the mechanical arrangements for returning the pencil to zero, its indications were left unrecorded for intervals varying from 3 to 4 minutes every hour. An electrical attachment has now been substituted for part of the mechanism, so as to reduce the time lost to about 20 seconds hourly, and the instrument is at present working in the experimental house.

The spare Barograph, belonging to the Meteorological Office, is also erected in the experimental house, for the purpose of trying various photographic processes suggested from time to time as desirable substitutes for those now employed in the preparation of the curves for the registering instruments.

Although there has been a slight falling off in the total number of barometers verified as compared with last year, yet as regards thermometers the result is highly satisfactory, the number of these instruments having considerably

increased. This is due to the great demand for verified clinical thermometers. The total number of instruments which have passed through the Observatory during the year was 4881.

Some very old Standard Thermometers having been recently tested, the Superintendent has been instructed to draw up an account of the changes in their indications, for presentation to the Royal Society.

A new form of thermometer has been designed by Mr. Whipple, and constructed by Mr. Hicks, for the purpose of conveying indication of temperature to a distance by means of electricity, without the necessity of employing intervening clockwork. Professor W. G. Adams has made a set of experiments with this apparatus in the laboratory of King's College, and reports favourably upon its performance.

The difference between the Old Royal Society Standard Barometer and the Kew standards having been well determined, the daily comparisons were brought to a close in March last. The former instrument is to be shortly returned to Burlington House, and again set up in the apartments of the Royal Society.—*Jan. 10th*, 1880.

RADCLIFFE OBSERVATORY, OXFORD. E. J. Stone, M.A., F.R.S., Radcliffe Observer.—No break has occurred in the series of observations throughout the year.

The readings taken at 8 a.m. and 6 p.m. have been forwarded daily, by telegraph, to the Meteorological Office.

The readings taken at 0.45 p.m. are for the synchronous series, published in the American 'Bulletin of International Meteorological Observations,' and are sent in bi-monthly parts, in duplicate, to the Meteorological Office, for transmission to Washington.

The instruments for photographic registration of barometer and thermometer readings are being replaced by another set on the Kew model, which has been kindly lent by the Meteorological Council.

The Meteorological Observations for the years 1876-9 are prepared for press, and will shortly be printed.—*Jan.* 1880.

CAMBRIDGE OBSERVATORY. Professor Adams, M.A., F.R.S.—The Meteorological work has been carried on by Mr. Todd as in former years ; no change has been made in the instruments, or the time of observations.

The 0.45 p.m. G. M. T. synchronous observations are still continued, and regularly sent to the Meteorological Office. A yearly summary of the meteorological observations has been drawn up for the 'Cambridge Chronicle,' and likewise for Mr. Symons.—*Jan. 8th*, 1880.

STONYHURST OBSERVATORY. Rev. S. J. Perry, M.A., F.R.S.—The complete series of self-recording and also of eye observations of the meteorological instruments has been uninterrupted during the past year. The hourly measures of the magnetic curves have also been continued as before, along with the weekly and monthly determinations of the absolute values of the magnetic elements.

To the previous astronomical work a branch of research has this year been added, which may possibly have some bearing on Meteorology. A large automatic spectroscope has been adapted to the 8-inch achromatic telescope, with the view of obtaining, as far as possible, a daily record of the variations of the chromosphere.

The Observatory takes part in the synchronous observations started this year in connection with the French Meteorological Office.—*Jan.* 1880.

Description of the Card Supporter for Sunshine Recorders adopted at the Meteorological Office. By Professor GEORGE GABRIEL STOKES, M.A., F.R.S.

[Read December 17th, 1879.]

THE method of recording sunshine by the burning of an object placed in the focus of a glass sphere freely exposed to the rays of the sun, which was devised by Mr. Campbell, commends itself by its simplicity, and seems likely to come into pretty general use. In the original form of the instrument the rays were received on a hemispherical wooden bowl, concentric with the glass sphere, and of such a radius that the focus should fall on its inner surface. The instrument in this form will give total effects, but only in a very rude manner the results for individual days, since the burnings produced on neighbouring days run into one another, and to use a fresh bowl for each day on which the sun shone would be out of the question on account of the expense. Accordingly it is expedient to adopt Mr. Scott's modification of the instrument, and replace the wood by a slip of card, which can be renewed from day to day; and it is necessary to support the slip in such a manner that the image of the sun shall not run off it from sunrise to sunset, and moreover that the focus shall fall, approximately at least, on the surface during that interval.

The most obvious way of supporting the slip would be to make it rest against the inner surface of a hemispherical bowl formed of metal, slate, or earthenware, and such is the plan adopted at the Royal Observatory. But this method could hardly be intrusted to inexperienced observers; for, in order that the slips may sufficiently nearly fit the surface of the hemisphere, they must be narrow; and in that case a moderate error in the placing of a slip would suffice to make the image of the sun run off it in some part of the day. Yet there is nothing to guide the observer as to the proper placing but certain marks on the hemisphere, respecting which he might easily make a mistake, especially as the slip has to be fastened by clamps. The slips have to be cut of a particular form, varying with the declination of the sun; and though correctly cut slips could be furnished from head-quarters, so many different patterns are required in the course of the year that there is risk of confusion on part of the observer. If a dated blank slip were returned to the Office, there would be nothing to indicate whether the absence of marks of burning really arose from cloud, or was due to a misplacement of the slip in the bowl.

Other forms of support have been devised in which the card is simply slipped into its place, so that the fastening presents no difficulty. But these mostly labour under one or other of two defects, namely, that in the course of a long day the image is liable to run off the slip, or that when the sun is a good way from the meridian its image is too much out of focus.

It seemed therefore desirable to devise a form in which these defects should be avoided, while at the same time it should be sufficiently cheap in

construction, and should demand little skill on the observer's part in the placing of the cards.

It is believed that these requirements are satisfied in the form adopted by the Meteorological Office.

It is well known that a piece of paper or card, regarded as a flexible but inextensible plane surface, cannot be bent, without rumpling or tearing, into the form of a sphere, but only into that of some developable surface. The locus of the focus of the sun's image for several successive days is a zone of the focal sphere, and this zone may be replaced without sensible error by a zone of a developable surface touching the sphere along the middle of the zone, that is, along a small circle which represents the path of the image for a single day, the change of declination during the day being neglected. The developable surface which touches a sphere along a small circle is of course a right circular cone. When the sun is in the equator, and the small circle becomes accordingly a great circle, the cone passes into a cylinder.

We must make provision for receiving the image through a range from 23°28′ north of the equator to 23°28′ south, or say for round numbers, and to allow a little for the breadth of the image, from 24° N to 24° S. Let C (Fig. 1) be the centre of the sphere, A E an arc of a section of the focal

Fig. 1.

sphere by a meridian plane through C, the arc extending from 24° N at A to 24° S at E, G G a portion of a section of the sphere. Divide the arc of 48° A E into three equal parts A B, B D, D E, and draw tangents through the middle points of these arcs, cutting the radii through A, B, D, E, in *a*, *b*, *d*, *e*. Then the zone of the spherical surface generated by the revolution of A E may be replaced with very little error by zones of two conical and one cylindrical surface, these zones being generated by the revolution of *ab*, *de*, *bd*; and these being developable surfaces, bits of card may be applied so as to fit them accurately. If R be the radius of the focal sphere, the extreme

error of focus committed will be R (sec 8°—1). If the glass spheres be of 4 inches diameter, and the glass be free from lead, R will be a little under 8 inches, and 8 (sec 8°—1)=0·0275 nearly, so that the greatest error of focus would be the 1-36th of an inch. If instead of the central tangents we take lines parallel to them, and passing through the middle points of A*a*, B*b*, D*d*, the greatest error will be halved, or reduced to the 1-72nd of an inch; and as the spheres burn very well through a range of 0·1 in. in distance from the centre, the small error of the 1-72nd of an inch is of little consequence. If we add, say 0·020 inch for the thickness of the card, and deduct ½ 0·0275, or say 0·014, for the reason above mentioned, we get 0·006 to be added to the distance of the best burning focus from the centre to get the perpendicular distance from the centre on any one of the three supporting surfaces. This correction is so small that it may be neglected. In the pattern adopted this perpendicular is taken at 2·89 inches.

The fiducial supporting surface is now reduced to that generated by the revolution of *a b d e* about the polar axis through C, a line therefore parallel to *bd*. This forms the inner surface of the supporting material; and from the winter to the summer solstice the image travels from *a* to *e*. From about October 14 to February 27 the image is on some part of *ab*; from February 28 to April 10 in some part of *bd*; from April 11 to September 1 on *de*; and from September 2 to October 18 again on *bd*.

If the cards were in section no larger than the exact sizes *ab*. *bd*, *de*, here given, the image would at certain times of the year fall exactly on the edge of a card. The cards must therefore be a little larger; and in order that they may lie without any rumpling on their fiducial developable surfaces, the material of the support must be slightly cut away by prolonging a little in each direction the cuts *ab*, *bd*, *de*. The prolongations of the cut *bd* might even be made to extend a good way towards the middle points of *ab*, *de*, and similarly for the others, without removing more of the supporting surfaces than can perfectly well be spared. The prolongation of the cuts may be utilised for the support of the cards by undercutting, so as to leave flanges under which the edges of the cards may be slipped. The form thus finally assumed by a section of the supporting surface is represented in fig. 2.

FIG. 2.

The construction of the supporting surface is not expensive. A ring is cast of the approximate form generated by the revolution of the section in fig. 2, the middle zig-zag line being however replaced by a circle as in fig. 1,

and the shaping of the inner surface and the undercutting are then done in the lathe. When shaped, the ring is cut into two by a plane through its centre, and inclined to its axis at an angle roughly equal to the latitude of the place for which it is intended. One ring will thus serve for two instruments, each half being mounted independently on a suitable support.

The forms of the cards are easily found. The equinoctial slips are of course straight. The form of the ends of these and of the other slips is not now considered for a reason which will presently appear. If we regard the summer and winter slips as infinitely thin, and coinciding with the surfaces on which they rest, it is evident that when developed they will form portions of circular annuli, the bounding arcs having a common centre where the line *ab* or *de* in fig. 1 (p. 84) cuts the polar axis. The radius of the developed slip, measured to the arc corresponding to the point of contact, will accordingly be 2·89 cot 16°. If we allow 0·02 for the thickness of the card, it will be more accurate to take 2·88 for the co-efficient; and if we suppose the depth of the cuttings at the two sides the same, so that the point of contact is in the middle of the card, and if b be the breadth of a card in inches, the outer and inner radii will be $10{\cdot}04 \pm \frac{1}{2}\, b$ inches.

The pattern of the rings, which form the only part of the apparatus involving much nicety in construction, is common to all the earth, and at whatever place the ring is to be used the circle in which the inner surface is cut by an ideal equatorial plane is divided by the plane of actual section into two equal parts; it is only the inclination of the cutting plane to the equator which changes from place to place. If a common mean latitude were adopted for the whole of England, little error would be produced; the semi-rings in the more northerly stations would merely rise slightly above the horizontal plane through the centre of the ball on the northern side of the east and west points, and pass a little below it on the southern side, while for stations south of the mean latitude the error would be reversed. As the sun hardly ever burns when very near the horizon, this would be practically of no moment. In that case a common pattern might be adopted for the ends of the cards of any one of the three kinds, but as it is desirable to take in somewhat wider ranges of latitude, such as from Jersey to the Orkneys, and as it is just as easy as not to divide the rings according to the actual latitudes of the places where they have to be used, it has been decided merely to provide that the cards shall be long enough for all the stations, and to leave it to the observers to cut off the ends of the cards level with the horizontal edges of the semi-rings, where the complete ring has been divided. It is, however, only in the case of the equinoctial cards that there is any occasion to cut off the projecting ends, as the ends of the summer and winter cards are not in the way of the sun's rays, even at sunrise and sunset.

Each semi-ring is marked inside down its middle, that is, along the line in which it would be cut by a bisecting plane passing through the polar axis. In mounting the stands in the first instance, once for all, this line is to be brought into the plane of the meridian; and in the daily use of the instrument the cards are to be pushed till the noon mark comes to the marked line.

The cards may be graduated beforehand by printing on the cardboard. In planning them, if a batch of cards of the same kind are drawn with the back of one in the bosom of the next, there is very little waste, and the cards can be afterwards cut out by a suitable punch.

For the equinoctial cards the hour lines are evidently a series of parallel straight lines. The interval from one hour line to the next may be taken as $2{\cdot}88\,\pi \div 12$, or 0·754 inch. For the summer and winter slips the hour lines will be straight lines converging (as they lie on the cardboard) to the common centre of curvature of the outer and inner bounding circles. The distance from one hour line to the next, measured along an arc passing through the point of contact, will be 0·754 cos 16°, or 0·725 inch; and as it subtends at the centre of curvature an angle of only 15° sin 16°, or 4° 7′, the length of the chord will be sensibly the same. If the length of the prolongations of the cuts *ab*, *de* in fig. 1 is the same towards, as from, the equator, the arc of contact will be equidistant from the two bounding arcs, otherwise not.

Fig. 3, showing Stand Complete.

Each half ring is mounted on a slab of slate, to which is fastened a brass upright ending above in a flat surface, about 1 inch or 1½ inch square, inclined to the plane of the base by an angle representing an average latitude for the kingdom. The half ring is fastened by screws to this flat piece, being cast for the purpose in a form which is flat in the middle outside, as represented in figure 2 in section. The complete ring, as cast, differs from a solid of revolution in having two such planes opposite to each other outside, for the purpose of attachment to the slanting plane of the upright. A pedestal ending in a small cup carries the glass ball, which rests there by its

own weight; and even should it be blown aside by a very violent gale, it cannot fall out, at least in the instruments suited for our latitudes, as the horns of the half ring are not wide enough to let it through. It may, however, be cemented for security's sake. The instrument is mounted in its place as a fixture, and then contains nothing moveable except the glass ball, which (if not cemented) can be lifted out and replaced in its cup at pleasure. The cards are introduced at the edges of the half ring, with their upper and lower edges under their proper flanges, and then readily slip into their places. They are pushed till the noon hour line is a prolongation of the line marked inside on the brass, and the ends (in the case of the equinoctial cards) are then cut off level with the horizontal edges of the half ring, unless they should have been previously cut in the house, from the pattern given by one of the cards that had been mounted and cut in the instrument.

In mounting the instrument in place, the points to attend to are, (1) that it shall be level as regards east and west, (2) that the axis of the ring shall be inclined to the horizon at an angle equal to the latitude of the place, (3) that the plane passing through the axis of the ring and the meridian line marked on its inside shall be in the plane of the meridian. There is no occasion to change the pattern of the upright supporting the half ring, since variations of latitude may be allowed for in bedding the slate.

DIRECTIONS FOR ADJUSTING AND USING THE SUNSHINE RECORDER, AS USED BY THE METEOROLOGICAL COUNCIL.

The instrument when in position faces the south; the glass ball rests on the pedestal, and when the sun is shining casts an image which chars a slip of card previously placed in the instrument. As the sun travels from east to west, the place of the image gradually moves along the card, which is thus scored during sunshine, and left untouched when the sun is hid.

1. Adjustment for Concentricity.—It is possible that the instrument may require this adjustment. To see whether it does, put the ball into its cup, and see whether in the horizontal plane passing through the ball's centre the surface of the glass stands at the same distance all round from the middle points of the belts on which the cards are destined to lie. If not, the pillar supporting the ball may be adjusted by loosening the screw underneath which fixes it, moving the pillar in the required direction, and when it is right, turning the screw home.

If the adjustment is not within the range of the hole in the slate, which for this object was designedly made a little large, the hole may be enlarged a little in the required direction by filing. Unless you are confident of being able to effect the adjustment thus, you had best not attempt the filing, but write to the Office.

2. Choice of Position.—It is almost needless to remark that a position should be chosen where a clear view of the sky, or at least of such portions of it as the sun is liable to occupy, is as little as may be interfered with by buildings, trees, &c. The instrument itself when roughly in position will show what portions the sun is liable to occupy.

3. Adjustment for Level.—The instrument is to be placed level as regards east and west, though at most stations, as will be mentioned presently, it requires to be tilted a little in the plane of the meridian. The plane of the top of the instrument, that is, the plane of section of the bowl, may perhaps not be quite parallel to the upper surface of the slate base, and in adjusting for level it is well not to trust to the surface of the slate, but to use the plane of the top of the bowl.

4. Adjustment for Latitude.—In most of the instruments which have been made for the United Kingdom, the brackets supporting the bowl have been made to a common pattern, suited to a mean latitude of about 53°. Except for stations very nearly in that latitude, the stand will require to be tilted a little in the plane of the meridian, through an angle equal to the difference between 53° and the latitude of the place. At stations north of 53°, the northern edge of the stand will require to be raised, at stations south of 53° the southern. For the moderate differences of latitude with which we are concerned, the elevation of edge required may be taken nearly enough at one-eighth of an inch for each degree of difference between the latitude and 53.°

In some few of the instruments the brackets have been made to suit a different latitude. In such cases the above rule will apply on substituting that latitude for 53°.

The above rule will suffice for making the adjustment for latitude very nearly right. To test and if need be correct it, the height of the image of the sun should be noted on some day when the sun is shining within an hour or so of noon, and compared with the proper height for that day. This may be obtained from the accompanying woodcut, which represents a section of the inner surface of the bowl by a plane passing through the polar axis of the ball. The figure is graduated for every 2° of the sun's declination, as well as for the maximum declination; and the days in the spring and autumn

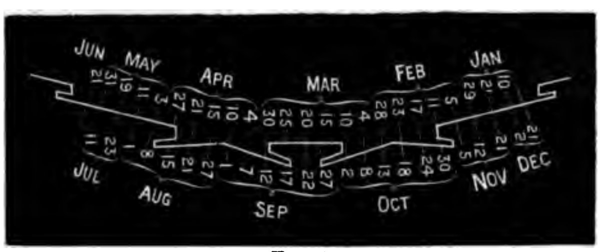


Fig. 4.

halves of the year at which the sun has most nearly any one of these declinations are written on the woodcut. Should the day on which it is wished to test the adjustment be some intermediate day, the proper place of the image may be obtained by estimation, remembering that the declination changes very slowly about each solstice.

5. Adjustment for the Meridian.—This adjustment is best made by means of the time; and as fairly correct time can now nearly everywhere be

obtained, it seems needless to give methods of adjustment in which the time is supposed unknown.

Supposing then the instrument placed roughly in the plane of the meridian, it may be adjusted, provided the sun is shining about noon, by turning it a little, if necessary, in azimuth, so as to make the image of the sun cast by the ball fall on the meridian mark in the instrument at the moment of *apparent local* noon.

We are not restricted to noon for the adjustment. Any other hour may be taken, supposing the card to have been properly inserted, by taking advantage of the hour lines marked on the card. At the moment when any hour is reached according to apparent local time, the instrument is to be turned so as to cause the image of the sun to fall on the corresponding hour line. Should it be cloudy at noon, it would be well to choose for the adjustment an hour not very far from noon, as in that way defects in the other adjustments would have no appreciable effect on the adjustment for the meridian.

This supposes the correct time to be at least fairly well known. The time got from a railway clock will probably be Greenwich or Dublin, &c. time, and to get the local mean time we must first add or subtract a time proportional to the difference of longitude between the station of observation and the place the time of which is given by the clock, at the rate of 4 minutes per degree, adding or subtracting according as the station of observation lies east or west of the place for which the time is given by the clock. Having thus got the local mean time, the local apparent time will be obtained by adding or subtracting the equation of time, as given in the accompanying table.

TABLE giving for every Third Day in Leap Year the Equation of Time to the Nearest Half Minute, to be added to or subtracted from Local Mean Time, according as the Sign is + or —, in order to get Local Apparent Time.

Day.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.
1	— 3½	—14	—12½	—4	+3	+2½	—3½	—6	+ ½	+10½	+16½	+10½
4	— 5	—14	—12	—3	+3½	+2	—4	—6	+ 1½	+11½	+16½	+ 9½
7	— 6½	—14½	—11	—2	+3½	+1½	—4½	—5½	+ 2½	+12½	+16	+ 8
10	— 7½	—14½	—10½	—1	+4	+1	—5	—5	+ 3½	+13	+16	+ 7
13	— 9	—14½	— 9½	— ½	+4	0	—5½	—4½	+ 4½	+14	+15½	+ 5½
16	—10	—14½	— 8½	+ ½	+4	— ½	—6	—4	+ 5½	+14½	+15	+ 4
19	—11	—14	— 8	+1	+3½	—1	—6	—3½	+ 6½	+15	+14½	+ 2½
22	—11½	—14	— 7	+1½	+3½	—2	—6	—2½	+ 7½	+15½	+13½	+ 1
25	—12½	—13½	— 6	+2	+3½	—2½	—6	—2	+ 8½	+16	+12½	— ½
28	—13	—13	— 5	+2½	+3	—3	—6	—1	+ 9½	+16	+11½	— 2
31	—13½	—12	— 4	+3	+2½	—3½	—6	0	+10½	+16½	+10½	— 3½

6. Confirmation of Adjustments.—In order that each of the adjustments mentioned above should be sufficiently exact the other adjustments would have to be nearly right. Hence, when the adjustments are deemed to be right, they should be tested, which may be easily done when the sun shines, even though not quite continuously.

The adjustment for the meridian and the adjustment for level east and west are tested together by seeing whether at *apparent local* noon (or at 11 a.m., 1 p.m., &c.) the image falls on the noon hour line (or on the 11 a.m., 1 p.m., &c., hour line), and whether the line scored by the sun on a card runs parallel to the nearest edge of a flange confining the card. Theoretically, it should not be *quite* parallel, on account of the change of declination of the sun during the day; but even near the equinoxes this is too small to come under notice.

If reasonable care has been taken in levelling the top of the bowl in an east and west direction, no material error of level is to be feared; and a defect of parallelism of the score to the flange, though such as might be produced by an error of level, should lead the observer rather to question and to re-examine the adjustment for the meridian. It may be that when the adjustment was made incorrect time was used, or the correction for the equation of time was forgotten, or applied with a wrong sign.

The adjustment for latitude is tested by seeing whether the image of the sun falls at the proper height on the card corresponding to the day of the year.

Once well adjusted, the instrument need not be disturbed, and it may be fixed in its place by cement or otherwise. It is possible, however, that at some stations, from the positions of buildings, &c., one place might be best for the instrument in summer, and another in winter. In such cases there is no objection to making the change. Of course the instrument will have to be re-adjusted after each change of position.

For the sake of those who wish to make use of the mathematical expressions for the errors of time and parallelism produced by given small errors of level and azimuth, the expressions are here subjoined.

Let l be the latitude, δ the sun's declination, both reckoned positive when north, a the small error of azimuth, λ that of level east and west, h the error of hour angle entailed, p the error of parallelism, a, λ, h, p being respectively reckoned positive when in the direction of the hands of a watch to an observer looking vertically downwards for the first, horizontally northwards for the second, downwards in the direction of the earth's axis for the third, downwards in the direction of the sun's rays at apparent noon for the fourth; then—

$$h = \left\{ a \sin (l - \delta) - \lambda \cos (l - \delta) \right\} \sec \delta,$$

$$p = (a \cos l + \lambda \sin l) \sec \delta,$$

and

$$a = p \cos (l - \delta) + h \sin l,$$
$$\lambda = p \sin (l - \delta) - h \cos l.$$

7. Choice and Insertion of the Cards.—Cards are provided of three patterns, rectangular for the equinoxes, and curved for summer and winter. The summer and winter cards are alike except as to length (the summer cards being the longer), and as to having the hour figures printed so as to

be seen erect when in the one case the convex and in the other the concave edge of the card is held uppermost.

It will be noticed that the bowl is undercut inside so as to leave six grooves roofed in by flanges which are destined to confine the edges of the cards. The grooves or their flanges will here be numbered from the top downwards. The winter cards are inserted, concave upwards, with their edges under flanges Nos. 1, 3, and slid along till the noon hour line is against the line marked on the brass. Should the two marks on the brass not exactly agree, that nearest to the equator of the instrument had best be used. Nothing more is required in general till next day, when the card is pulled out and a fresh one put in. In time of snow, however, when there is any chance of sunshine, the snow should be removed from between the ball and the card.

If the sun should be shining when a fresh card is being put in, the observer should stand on the south side of the instrument, or otherwise shade the ball, lest a false score should be made on the card before it gets into the proper position.

The equinoctial cards are similarly inserted, with the hour figures erect, under flanges Nos. 2, 5, and the summer cards, convex uppermost, under flanges Nos. 4, 6.

The equinoctial cards are to be used during March and the first 12 days of April, and again during September and the first 12 days of October; the summer or winter cards, as the case may be, are to be used during the remainder of the year.

8. Shortening of the Equinoctial Cards.—If the ends of the equinoctial cards were left projecting above the brass frame, they would intercept the sun's rays near sunrise and sunset. The parts projecting above the horizontal top of the frame should therefore be cut off. If the observer chooses, he may cut off the ends before inserting the cards, by cutting one in the instrument, and using it as a pattern by which to cut the others. It would be unnecessary to remove the ends of the summer and winter cards, as they are not in the way.

A large number of experiments were made by means of two similar instruments placed side by side, as well as more roughly in other ways, on the effect of different modes of darkening the cards. It might, perhaps, have been expected beforehand that black cards would have been the most sensitive. Such, however, did not prove to be the case. With blackened cards the earliest indication of an effect of the sun's rays consisted in a slight alteration of the texture, visible only when the card was held so as to catch reflected light; whereas, with a moderately darkened card an alteration of colour produced by the heat could be seen before there was any visible alteration of texture; and this singe could be seen simultaneously with the determinate burns without the necessity for holding the card in any particular direction. And though the first change would most probably be produced on a black card, experience proved that the first *visible* change was produced on a suitably darkened card.

The difference between different kinds of cards was, however, far less than might perhaps have been anticipated. It was only in catching a few minutes more or less of a very feeble sunshine that, with the exception, perhaps, of a few pale and unsuitable kinds, one card differed from another. Cards darkened to a grey with carbon were among the best. It was decided, however, ultimately to employ prussian blue only moderately dark. Such cards when viewed through a red glass, which transmits all the visible rays which are strongest in heating effect, looks almost black, while the rays of high refrangibility which it freely reflects enable the record to be easily seen, while entailing but little loss of absorption of rays powerful in their heating effect. It is needless to remark that if a pigment were chosen *merely* from *à priori* considerations, its behaviour with respect to the invisible rays lying beyond the red would have to be taken into consideration. But to do this experimentally would involve an expenditure of time which the value of the result would hardly justify, since the suitability of a pigment may be ascertained by direct trial.

DISCUSSION.

Mr. WHIPPLE thought that this method of mounting would not be suitable for all latitudes, as in the extreme north, where the sun shone both night and day during the summer, a complete circle would be required. It would be a great advantage if there were a loose paper holder instead of the fixed grooves. He believed that the amount of sunshine recorded at Greenwich in the early morning might be affected by the bowl partially obscuring the glass ball, and so diminishing the power of the glass to burn. It was found at Kew, that the instrument did not record till about 30 minutes after sunrise, and stopped recording about the same period before sunset.

Mr. ELLIS said that there was no fear of the register running off a strip $\frac{1}{2}$ an inch in width, in fact one position of such a strip would serve for many days. In regard to the circumstance that, in the Greenwich instrument, one half of the glass sphere was cut off by the brass bowl near to the times of sunrise and sunset, this point was considered by the Astronomer Royal when the instrument was first set up, and he attached no particular importance to it. Some expressions contained in the paper just read appeared to give an impression that in the Greenwich instrument there was considerable liability to error in placing the strips in position. The plan was perhaps suitable only for an observer of some experience, but he might mention, that with the appliances provided, an error in this respect was of rare occurrence.

Mr. SYMONS thought that if these instruments were set up in large manufacturing towns the grooves would become choked with smoke and verdigris. It ought to be stated in the reports that the register was of *bright* sunshine, for the disk of the sun was frequently visible during fog or mist, when no sunshine was recorded. He would like to know how soon after sunrise these instruments began to register.

Mr. ELLIS said that under the most favourable circumstances no register could be obtained within less than half-an-hour of sunrise or sunset. In the published results it was specified that the record was that of "bright sunshine."

Mr. MAWLEY thought that the fact of this sunshine-recorder being in all respects an English invention, added much to its interest, and that it would prove a valuable addition to the other meteorological instruments now in use at our observatories and private stations. The principal objection, however, against its general adoption appeared to him to be the difficulty of finding in ordinary gardens a suitable position in which to place it, such suitable position involving complete exposure to the sun throughout the whole of the day during the winter months. He intended placing his own instrument on the top of a stack of chimneys at the south end of his residence, no other position on the premises affording the needful exposure.

Mr. Casella said that he had recently given considerable attention to this subject, and had no doubt of producing an instrument in every respect satisfactory for less than £10, say more nearly £7 or £8.

Postscript by the Author, *March* 16*th*, 1880.

The instrument was designed for use in the United Kingdom, but there appears no reason why it should not be used even in extreme latitudes. At the North Pole, for instance, the plane of section of a complete ring would be the equatorial plane, and a half ring would go completely round the polar axis. It would merely be necessary to remove half-an-inch or an inch of the flanges confining the summer cards, in order to permit of the introduction of the end of a card. The card would then be slipped along in its grooves. A summer card for the North Pole, as it lay flat, would form an arc of an annulus with its ends in the direction of radii, and as it lay in position would form a complete annulus of a right circular cone, with a division down one generating line, where the edges of the slip of card would meet, without either overlapping or leaving a gap, if the card had been properly cut. The equinoctial cards would form complete annuli of a cylinder divided along one generating line. They would, it is true, have a flange to hold them in along one edge only, but that would be sufficient. What was said in the paper as to the liability to misplace a slip in a simple hemispherical bowl, such as that employed at the Greenwich Observatory, was intended only to apply to the case of observers of little or no experience. The cards actually used fit very easily into their grooves, so that it would require a good deal of dirt to make them jam. The grooves would tend to be kept clean by the daily removal and insertion of a card; and when the time came for shifting from one pair of grooves to another, a change made only 4 times in the year, it would, apparently, be no great trouble to clean sufficiently the grooves coming into use should they be found to require it.

On Typhoons in China, 1877 *and* 1878. By Lieut. Alfred Carpenter, R.N., F.M.S.

[Read February 18th, 1880.]

Let me describe one fully first, and then glancing over the others, comment on the whole.

H.M.S. 'Nassau,' surveying vessel, left Incog Islands at early morn on September 16th, 1878, and steamed up the coast, anchoring at Tiow-pung Island in lat. 28° 16′ N, long. 121° 38′ E, at 5.30 p.m., on the 17th. She experienced a considerable easterly swell during the whole of both days. However, the wind remained at N by E, from which point it had been blowing for a week, and there was no appearance of an atmospheric change until 4 p.m. of the 17th, when the weather looked decidedly wicked.

On the 16th we had had a fair sky, the cirrus being almost stationary, with slight motion from west. Towards night, however, there was a high stratus over the cumulus, but this was gone again by daylight, and did not return till 4 p.m. of the 17th, and then appeared in rolls. At midnight of the 17th-18th the lower clouds were logged "rapidly from north-east;" but after 6 a.m. the lower stratus completely enveloped us. On the 16th the lower clouds had been from NE, though the wind was from N by E. The force of wind was 4 to 6—squally—when we anchored. At 9 p.m. the barometer, then showing 29·806 ins., commenced resolutely to fall.

At 2 a.m. on the 18th the wind had backed to N by W, force 4 to 6; and I may here observe, that the 'Nassau' was anchored on an open coast, the trend of which was likely to influence the direction of the wind slightly when about N.* At 6 a.m. wind NNW, steadily freshening, force 5 to 7, barometer 29·692 ins., and rain had set in. At 10 a.m. wind returned to N, and shortly after N by E. Heavy rollers setting in from ESE, and breaking in 7 fathoms water, were racing to the shore. The ship, protected, however, by the point of an off-lying islet, lay in the swell without being in the breaking surf. Estimating carefully the distance of ship from shore, and taking the time between the passage of each swell from under the ship till its break on the rocks, I calculated their rate of travel to be 24 miles per hour, on both the 18th and 19th. The number of swells passing was 10 in 2 minutes. The wind remained N by E, freshening to force 6 to 8 by 1 a.m. on the 19th, barometer 29·51 ins., and rain.

A bright yellow sunset had occurred, and I had seen a double rainbow between the squalls of rain; the primary bow having another red and a greenish band under the violet for a few minutes. At 2 a.m. on the 19th the wind was at NNW, and it now steadily backed to NW by W by noon; barometer then 29·25 ins. Frightful squalls of wind and rain; force of wind recorded as 9 to 10. Barometer pumping from 4 a.m. to 1.30 p.m., when it reached its lowest, viz. 29·286 ins.

Our energies had been put to the test all this time, dropping three anchors, dragging them, laying them out again and steaming up to them, whilst all top hamper had been got down. The surface drift at noon was 2½ knots S by E, and from noon till 4 p.m. the wind varied from NNW to WNW; rain having ceased. At 2.30 p.m. the swell suddenly moderated, and at 4 p.m. the surface current set northward for the first time for 46 hours. The wind steadied at 4 p.m. to NW, force 8, barometer rising, and now 29·294 ins. At 7 p.m. wind NW by W, force 5 to 6. A mauve-coloured sunset with an appearance of rolled cumulus. At 1 a.m. on the 20th wind WNW, force 2 to 5, squally, barometer 29·492 ins., steadily rising, only a few sharp puffs to show that there was any disturbing element in the then clear and beautiful night. At 4 a.m. wind W, barometer 29·51 ins.

* Tiow-pung Island lies N by E and S by W, and is high; and having Shetung Island on our E hand (also high, though small in circumference) such winds were gullied between the two islands.

As we steamed to the northward on the afternoon of the 20th, we found fine and calm weather, but confused undulations from all points of the compass.

The various ship's logs that I overhauled tell the same tale of the warning swell; the rain before and during proximity to cyclonic centre; the immense extent of its influence; the clear up and beautiful weather in its wake.

We find then on September 16th the cyclone, in lat. 24° N, long. 130° E, coming up in full swing from ESE. After passing a little to the southward of Lu-chu Islands it approached the coast on a NW by W course; at this time the barometer showed similar readings (29·70 ins.) at Nagasaki in Japan, at Tiow-pung Island, China, and on board a ship about 180 miles east of Tiow-pung Island; therefore the cyclone did not pursue a path along a valley of very low pressure, as did the celebrated August West Indian hurricane.

The rate of its approach was 7 miles per hour, and its course commenced to recurve at 4 a.m. on the 19th, in lat. 27° 45′ N, long. 123° 15′ E, the distance from the coast during arc of recurvature being about 65 miles. It then ran up the coast in a NNE direction, and broke into a greater speed of about 10 miles per hour, which it maintained to lat. 31°; then again curving away from the Yellow Sea, crossed Quelpart Island, and was traced to lat. 36°, long. 130°, probably continuing diminished in strength up the NW coast of Japan. The length of this ascertained track is 1,000 miles.

The outer winds blew nearly in a circular direction, varying 2 or 3 points either way. Within a radius of 180 miles of the cyclonic centre, the spirality commenced at 1 point, and increased to 3½ points incurvature near the centre.

The diameter of the Typhoon varied from 300 to 600 miles. The swell it created was plainly felt 600 miles from the centre. No report was made of any central calm until after the Typhoon had passed Quelpart Island. In the other Typhoons of 1877 and 1878, central lulls were reported.

A gradient read between the barometers of the 'Nassau' and the 'Star Queen,' when those ships were in line with cyclonic centre, gives ·01 in. to a mile; the 'Star Queen' being then 20 miles to the left of the centre. In general the gradient in front of its path seemed more gradual than that to the left, but I have hardly sufficient observations to ensure this being correct all through.

Its sea-driving power was very great, endangering several vessels off the Yang-tse-Kiang, and flooding the harbour of Nagasaki to the detriment of the cultivated valley at its head. The lowest readings of barometer were 28·37 ins. on board a ship, that ran in a quadrilateral for 4 days off the Chi-Kiang coast; and 28·38 ins. in a vessel near Quelpart that spent some hours on her beam ends. With the exception of our quadrilateral friend, the vessels concerned in this discussion showed a surprisingly good knowledge of Typhoon laws.

The heat had been unusually great, and the summer a moist one in the north of China, but dry in the south. For 3 weeks prior to September 15th there had been a calm or light NE monsoon, freshening to moderate NNE

after the 10th inst. After the Typhoon the heat increased at Shanghai to the ordinary July temperature, but fell at last on the 26th. On the 15th rain began in Yeddo Bay, and in 30 hours 6·9 ins. fell; the SW monsoon blew in 1877 and 1878 from the end of May to August 22nd, but, for a monsoon, it is a fitful breeze north of Hongkong at the best of times. This year also the NE monsoon set in in the 4th week of August.

On the night of September 21st-22nd, 1877, a Typhoon struck the China coast a little south of Haitan Straits, travelling NNW 6 miles an hour, and having a subsidiary cyclone on its right rear quadrant, distant 40 miles.

On July 30th-31st, 1878, a Typhoon struck the coast a little north of Wenchow, at the entrance to which place H.M.S. 'Nassau' was anchored, parties being away surveying. I was camped out on a small turf-topped rock, and I never want to endure another night like that one; the tents blown down, ourselves blown out like clothes when drying on a line, and our boats torn from their moorings, gave me practical experience of the force of wind: but this is only a digression.

The general course of this Typhoon was NW by N, and its rate of travel 10 miles per hour; on the 30th the upper clouds were from ESE, wind NE; on the 31st they were from W, wind SW; there was heavy rain in front of and in proximity to centre; its diameter was 300 miles.

On October 8th, 1878, a Typhoon, having passed some 60 miles south of Formosa, travelled westerly, and struck the coast 50 miles SW of Hongkong; its diameter varied from 180 to 300 miles; the rate of travel being 15 miles per hour; the diameter decreasing as it neared the coast. The 'Nassau' had been scudding before a NE gale, and a very heavy sea, in the Formosa Channel, for 30 hours. She then ran into the NW quadrant of this Typhoon, and as there was no change in direction of wind did not appreciate the new cause of disturbance. The result was melancholy for the 'Nassau,' as she lost a great many sails, boats, and spars.* The height of the sea from crest to vortex carefully taken was 21 to 22 ft.; the actual surface being driven like snow in smooth flakes by the force of wind.

Almost on the same day of this month in the previous year a Typhoon, travelling NW by N, struck the coast of Japan between Yokohama and Kobë.

On July 5th, 1877, a Typhoon struck the coast near Breaker Point, travelling NNW, and passed inland. Its diameter was about 130 miles, and its rate of travel 11 miles an hour. H.M.S. 'Nassau' was in the left semicircle, and the China Revenue gunboat 'Chêu-to' in the right. They were equidistant from centre, and their observations were very symmetrical.

On September 11th-12th, 1878, Captain Reeves, of the P. and O. Steamer 'Sunda,' met with a Typhoon, of small diameter, but of severe force, off the SW end of Japan, a point where the northern Typhoons frequently recurve. He first observed a peculiar arched bank of cloud rising on the eastern horizon, extending from SSW to N. When this reached an altitude of about 40° he ran back to the westward, and for some hours

* This typhoon really struck the coast on a WNW course.

followed the western edge of the Typhoon as it recurved to the northward. Its first direction had been from ESE, and the storm appeared to be retarded at the point of recurvature.

There were also 2 Tornadoes in 1878; one on April 11th exceedingly violent, and about 200 yards in diameter, with a speed of 8 miles an hour, travelled in a NE direction over Canton, doing unparalleled damage, and causing great loss of life. Another on May 22nd, having a diameter of 180 yds., travelled quickly over the town of Tai-wan-fu on the SW coast of Formosa, doing great damage. On the previous night we had had a grand thunderstorm at Hongkong, the lightning being continuous; 9 ins. of rain fell in 6 hours, the lower clouds driven rapidly from SW. This, the first of the SW monsoon, arrived at Tai-wan-fu at 5 p.m. on the 22nd, and there met some black clouds, which had been passing over that town rapidly from N. The Tornado probably commenced within a mile or two of the town.

A small Tornado passed over Canton in 1877, and another over Wenchow on July 3rd, 1877. There were besides a few minor gales reported as "tail-ends" of Typhoons in the Japan seas.

Summing up then—1st. We find 6 distinct and destructive Typhoons in the China seas in 1877 and 1878, and a few minor ones in the north: 2nd. That when yet some distance from the coast, they were travelling W to WNW; that, on nearing or striking the coast, 4 out of 6 ran on a NW by N course nearly, 2 recurved northward and NE, and one which had commenced W½S struck on a WNW course: 3rd. That the average rate of progression was 11 miles an hour.

During these Typhoon months the Japan current sets 30 to 40 miles a day NE up the whole China coast, and along the SE coast of Japan; this belt of warm water may perhaps form a wall of heated air that tends to divert the course of the Typhoon.

During these same months the barometer curve showed 7 day waves; during the first 2 days of the anterior incline the weather would be thundery, with probably some wet. It would then clear with rising wind until the maximum was reached; after which calm and variable winds set in on the posterior decline, ending with squally and wet weather at the bottom of the curve.

The amplitudes of the curves were so small that a very slight irregularity was sufficient to resolve these waves into 10 day and 4 day periods, or 9 day and 5 day periods. The diurnal variation of the barometer on that coast was ·008 in., and was so regular that a fall of ·012 in. at 10 a.m. on July 31st instead of the usual rise warned us that a disturbing element was about.

Note on the Reports of Wind Force and Velocity during the Tay Bridge Storm, December 28th, 1879. By Robert H. Scott, F.R.S.

[Read February 18th, 1880.]

I have recently received an application from Mr. C. Barlow, C.E., for information as to the reports of the wind when the Tay Bridge was carried

away; and I have thought that it might interest the Society if I were to communicate to it the facts I have already sent to Mr. Barlow, and supplement them by a few notes of other serious storms which have been registered by our self-recording anemometers.

The following are the data which I furnished to Mr. Barlow:—

"The greatest number of miles registered in any 60 consecutive minutes on the evening of December 28th, 1879, was 71, at Glasgow, between 6.20 and 7.20 p.m. At Aberdeen the maximum registered was 68 miles, between 8.50 and 9.50 p.m. Both these velocities are higher than any shown in the tabulation sheets, the values in which are for the intervals between 30 minutes before and 30 minutes after the hours.

"Taking much shorter periods than 60 minutes the traces show still greater velocities. Thus at Glasgow I should estimate the *hourly* rates for the undermentioned intervals as follows:—

From 6.25	to	6.30	p.m.	96	miles	per	hour.
,, 6.55	,,	7.0	,,	72	,,	,,	,,
,, 7.15	,,	7.18	,,	120	,,	,,	,,
,, 7.30	,,	7.35	,,	84	,,	,,	,,
,, 7.45	,,	7.50	,,	96	,,	,,	,,
,, 8.43	,,	8.46	,,	110	,,	,,	,,

"Similarly, at Aberdeen, from 7.15 to 7.20 p.m., 8 miles were registered, equalling a velocity of 96 miles per hour."

With reference to these very high velocities, I should remark that the scale of our anemograms is so contracted that I do not myself claim for such figures very precise accuracy. Any unsteadiness in the action of the spiral recording pencils of the instruments might produce temporary irregularity in the trace, which might give an apparent excessive velocity for a few minutes.

On the other hand, as already stated in my Paper (Quarterly Journal, Vol. II. p. 109), it is not possible to compare satisfactorily the indications of velocity and pressure anemometers, so that our instruments cannot record correctly the phenomena of sudden gusts.

These considerations being granted, it will be interesting to place on record the extreme velocities recorded during the storm at other stations not very far distant from Dundee.

At Alnwick Castle the anemometer recorded 65 miles between 6.40 and 7.40 p.m., and 60 miles an hour for the next two hours.

At Seaham Harbour the hourly velocity did not exceed 40 miles at the time of the wind's greatest force, say from 6 to 9 p.m.; but at 6.50, during a squall, the rate must have been at least 150 miles per hour. A note by the observer states that "the gusty force of the gale on Sunday night stopped the mill vane of the anemometer."

At Stonyhurst the total velocity never exceeded 30 miles in 60 minutes; there were, however, heavier gusts, and 60 miles per hour is shown for 10 minutes between 5 and 6 p.m.

At Armagh the maximum velocity recorded was 26 miles, between 6.30 and 7.30 p.m., but in a squall at 7 p.m. at least 80 miles per hour are shown,

and in a shorter squall at 5.30 p.m. a far greater velocity than this was reached.

At Holyhead and Sandwick Manse, both usually very windy stations, no velocities worth notice were recorded.

It may be interesting to give one or two instances of other exceptional gales.

In the tremendous southerly gale of January 24th, 1868, the Glasgow anemograph was the only instrument we had working in Scotland, for the instrument at Sandwick Manse was not in good repair, and the pendulum of the clock was stopped by the wind at a critical period of the storm. The Glasgow trace is unfortunately in an unsatisfactory condition. It was faint and was roughly pencilled over by the observer, so that it is now hopeless to trace out the original instrumental record. The highest velocity in an hour was 66 miles.

On February 20th, 1877, the Holyhead anemograph registered 82 miles an hour for 2 consecutive hours, and during the gusts the velocity was at least 200 miles per hour.

On November 16th, 1877, the Sandwick anemometer registered 83 miles in 60 minutes, and in this case also the gusts must have been very heavy; a 2 minutes' trace gives an hourly rate of 180 miles, and a 4 minutes' trace one of 120 miles.

It is not a little remarkable that these very high velocities at Holyhead and Sandwick did not do material injury to buildings situated close to the respective anemometers.

I have received various notes indicating the violence of the gale of December 28th in other parts of Scotland, but I do not think it worth while reproducing these in print, as they are not instrumental records.

DISCUSSION.

Mr. WHIPPLE said that he did not agree with the opinion expressed that the Robinson Anemometer did not give the true wind velocity in high winds; he believed the cups revolved with sufficient rapidity to follow any changes, but the fact was, that whilst they made 5,000 revolutions the pencil only moved over about 2¾ ins. For discussing such storm effects as those described in the Paper, a more open scale than the present one was desired, and no obstacle but the cost of paper for registration prevented the use of a time scale of a foot or more to the hour. Undoubtedly, high winds blew in gusts, and this was very evident when observing with a Hagemann's Anemometer, which would run up in rough weather from 0 to 9 or 10 in less than a minute. As an example of the effect of gusts, he had recently upon the roof of the Kew Observatory a massive wooden tripod with heavy iron top, but loaded at the base with sufficient weight to keep it steady, and probably necessitate the strength of 3 men to overturn it. A gust of wind blew it down, although the anemometer a few feet distant failed to register a higher velocity than 30 miles in the hour in question.

Mr. LAUGHTON said that it must not be forgotten that the Staff-Commander of the 'Mars,' lying a very short distance from the bridge, had estimated the force of the wind as not exceeding 11 on the Beaufort Scale, in the squalls. With this, as the estimate of an officer of long experience, he could not see what reason there was to suppose that the wind had any exceptional velocity. He himself was inclined to believe that the bridge did not give way to the mere force of the wind; but that as squall succeeded squall, a rocking or vibratory motion had

been established; that possibly by such vibration the structure was, to some extent, disintegrated, and it collapsed when the weight of the train came on it.

Mr. WHIPPLE remarked that the 'Mars' training ship was in a somewhat sheltered position, and would not feel the full force of the gale.

Dr. TRIPE thought that the comparatively moderate wind-pressure recorded on board H.M.'s ship lying near the bridge in a somewhat sheltered position should not be taken as proof that the centre of the bridge had not sustained a much greater pressure, and instanced a well known storm in America which had cut a passage through a forest about 200 yards broad, leaving the trees on either side uninjured.

Mr. STRACHAN believed that the carriages were blown off the rails and battered against the bridge. He thought that the velocities of the wind should be received with some caution. The time-scale on the anemograph sheets was much too contracted to allow of the measurement of velocities during short intervals with accuracy.

Mr. R. CURTIS said that it had always been a matter of surprise to him that meteorologists should give the number of miles recorded by an anemometer in an hour as a measure of the *rate* of the wind at any moment during that period, the two things being of course quite distinct; and it only required a very little reflection to see that such a practice might lead to very misleading conclusions. If a wall, or stack of chimneys, was blown down, and legal proceedings resulted, it frequently happened that an anemogram was produced to prove that as the velocity had been but, say, 20 miles per hour, the wind had been quite insufficient to do the damage,—overlooking altogether the fact that a sharp, but brief, squall might be wholly lost in the trace, which not unfrequently failed to suggest that the wind had been gusty, even when that had been its chief characteristic. To this substitution of number of miles recorded for rate per hour, he also attributed the fact that the relation between Beaufort's Scale for estimated wind force and velocity, and the relation between velocity and pressure of wind, had not yet been satisfactorily determined. He quite agreed that in measuring such high velocities as Mr. Scott had mentioned great care was necessary on account of the smallness of both the time and velocity ordinates of the scale; but still, after carefully allowing for this, he had met with many cases in which there could be no doubt those rates had been reached, and even exceeded. He believed there was no real difficulty in adapting Robinson's Anemometer to register the velocity of the wind in squalls, and this he regarded as the most necessary step to be taken towards obtaining a true idea of the actual velocities attained by the wind.

Mr. LAUGHTON said that Capt. Watson, with whose care and exactness as an observer the Society was well acquainted, had lately told him that some preliminary experiments which he had made with Hagemann's Anemometer seemed to promise well; and that he hoped to carry these experiments further, by bringing the pipe from the mizen-truck, down the mizen-mast, into his cabin. If such experiments were found successful, and when the constants of the instrument were once satisfactorily determined, it was possible that we might have an instrument peculiarly adapted for the measurement of sudden gusts.

Mr. C. HARDING considered that Mr. Scott's Table for the conversion of Beaufort's wind forces into miles per hour, given in the Quarterly Journal of the Society, Vol. II. p. 113, was the best in existence; he did not, however, think that the observations which were at present being conducted by Capt. Watson should be taken as confirming this Table. He drew attention to the very different values given by Sir Wyville Thomson in the 'Voyage of the Challenger in the Atlantic,' Vol. I., p. 61, for the conversion of Beaufort's Scale. The wind would generally be much steadier in force and the gusts less violent on the open sea than on land.

Mr. STRACHAN said that he formerly did not believe that Mr. Scott's Table was correct for the first four grades; but Capt. Watson having found his observed velocities to agree with Mr. Scott's computed velocities, he was now prepared to accept the Table.

Mr. JINMAN said that the wind rarely blows parallel with the earth's surface, and that anemometers to register the true pressure should be fixed so as to receive the pressure at different angles. He had seen scud being blown down and up, at an angle of 45°. The accident at the Tay Bridge occurred at the time when the central band, of what he had named the 'Eurydice' cloud bands, was

passing over, and these were times when, from their powerful attraction or sud-denly lifting from the earth's surface, gravitation was practically suspended, and he had no doubt that during one of these intervals a part of the train was lifted off the metals and dashed against the bridge. The force of the gusts of wind, great as they were in the open sea, during the passage of the bands, was most severely felt in valleys like that of the Tay.

Mr. MUNRO had heard it stated on good authority that the bridge could stand in a great gale.

Mr. GASTER agreed with Mr. Jinman that the wind does not always bl horizontally. He hoped that Mr. Jinman would favour the Society with a cise statement of his theory of the repetition of storms, and say how he dete in the storms of certain dates, to which he referred from time to time, repetiti of the 'Eurydice' squall.

The PRESIDENT (Mr. Symons) said that the ordinary Robinson's Anemome gave no information about the violence of squalls. It was very desirable an anemometer should be made with a more extended scale, so that the veloc of the wind during short periods could be readily seen. This had been done the Royal Botanic Society's Gardens, where the anemometer drives electric a hand over a dial close to the barometer, and this hand can easily be read every 5 or 10 seconds. Messrs. Negretti and Zambra also make a pattern small Robinson Anemometer, in which one hand describes a complete revoluti for each mile of wind, and thus enables the velocity during short intervals to easily read off. For his own part, he was inclined to believe the extraordina velocities which had been mentioned as occurring during very violent gus He had been told that trees rarely go down at the first blow, but always aft they had been rocking for some time. He believed it was Mr. Dines who h stated that there was not a single church steeple that could withstand a pressur of 30 lbs. on the square foot; but by whomsoever the statement was made, was difficult to harmonise it with the velocities and pressures mentioned in the discussion.

Mr. ELLIS remarked that if the velocities of 100 miles and more per hour spoken of by Mr. Scott, are to be accepted, the ordinary formula for conversion into pressures must be inaccurate, because such velocities sustained through several minutes would indicate a continuous pressure of 50 lbs. or more on the square foot. But in pressure instruments there appears to be no approach to any such condition; indeed, pressures of only 20 or 30 lbs. usually endure but for very short periods, to be counted by seconds rather than by minutes.

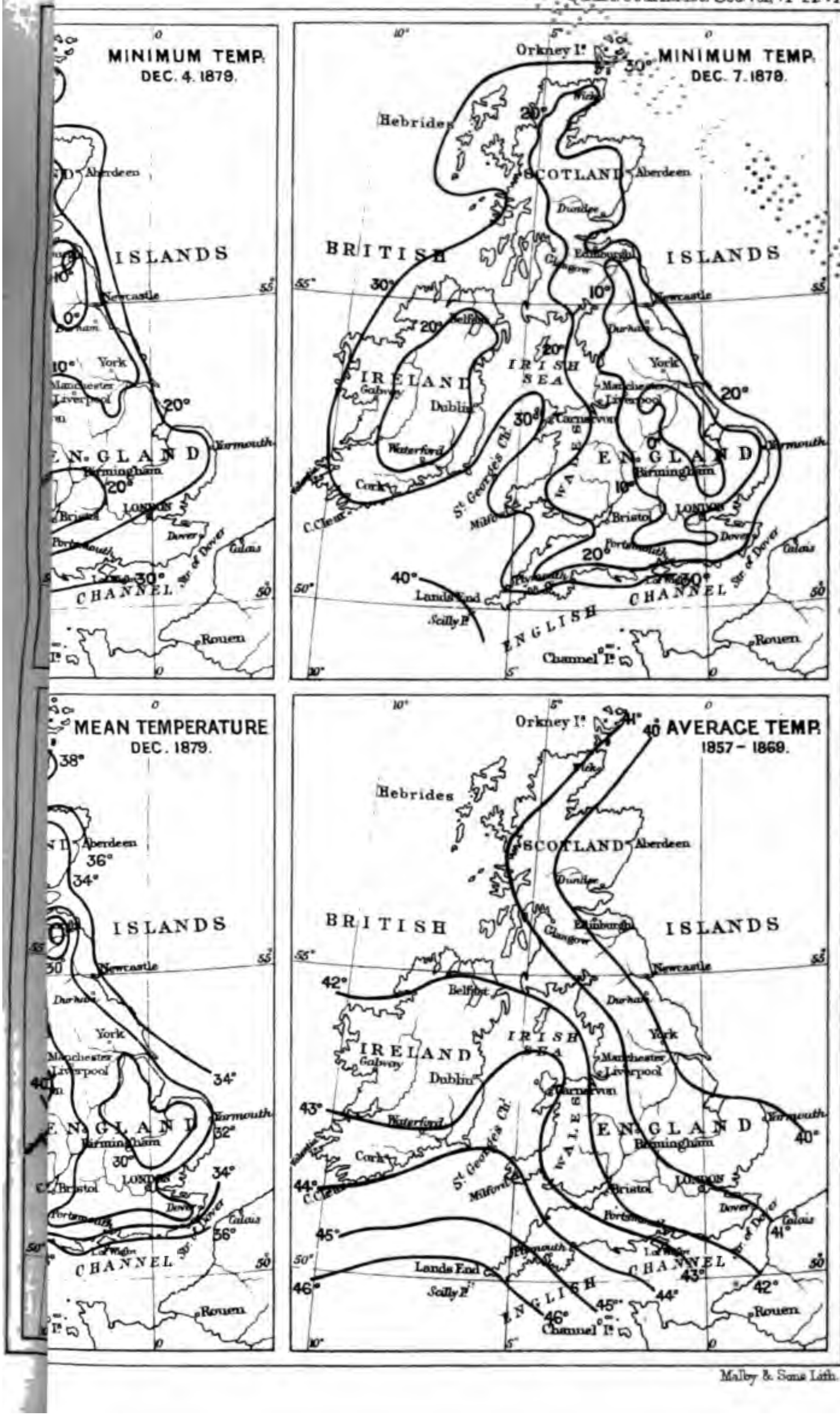
Mr. WHIPPLE hoped that Mr. Ellis would undertake a comparison of the wind pressures and velocities, as the material for discussion was already available at Greenwich. He would like to see the anemograph curves magnified 100 times during the time of passage of the centre of a storm.

Mr. SCOTT said that in his former paper on the relation between wind force and velocity, published in Vol. II. of the Quarterly Journal, he had given several instances of the intensely local character of strong gusts of wind. He feared that the scale of the Robinson's Anemograph at Greenwich was too contracted to afford data for a satisfactory comparison with the indications of the Osler's instrument close by. As to Mr. Jinman's remarks on the importance of measuring the motion of the air in directions other than simply horizontal, he could only say that some experiments on this subject had been made in Italy, but he was not aware that any results had been published.

On the Frost of December 1879, *over the British Isles.* By WILLIAM MARRIOTT, F.M.S., Assistant Secretary. (Plate VI.)

[Read February 18th, 1880.]

THE temperature of December 1879 was so remarkably low, that it has been considered desirable to investigate its intensity and distribution, and some of its effects.



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Application was made to a number of observers in different parts of the British Isles to supply their maximum and minimum temperatures for each day during the month. The readings, together with those from the Society's stations, and those received by the Meteorological Office (to which Mr. Scott has given me access), as well as some supplied by Mr. Buchan and Mr. Symons, have all been tabulated, and form the basis of the present communication.

The weather during the latter part of November was very cold, with scarcely any rain after the 18th. Exceptionally low temperatures were registered all over the British Isles from the 1st to the 7th of December. On the 1st the lowest temperature was —2° at Ketton, near Stamford; and the next lowest was 2° at Springwood Park, Kelso. The temperature continued low throughout the day, at many places not rising above the freezing point.

On the 2nd the cold was more intense. In the counties of Roxburgh, Leicester, Lincoln, and Nottingham, the temperature fell below zero, the lowest being —6° at Kelso, and —4°·5 at Coston, near Melton Mowbray. Temperatures between 0° and 10° were registered in the north and south of Scotland, and along the central part of the north of England to the midland and eastern counties; while over almost the whole of England, Scotland and Ireland, with the exception of the sea-coast stations, the temperature fell below 20°.

On the 3rd the cold was more severe in Scotland and the north of England than on the previous day; temperatures below zero being registered in the central and south-eastern parts of Scotland and the valley of the Tees. The lowest readings were —16° at Kelso, —5° at Blackadder, —4° at Thirlestane Castle, —2° at Gainford, and —0°·8 at Braemar. Over the whole of the central districts of Scotland and the north of England the temperature fell below 10°, while readings below 20° were registered over the whole of Scotland and the inland districts of England. In Ireland, Wales, and the south and south-western counties of England, the temperature ranged between 20° and 30°.

On the 4th, intensely cold weather was experienced over the south of Scotland and the north of England; the lowest temperature reported to me was —23° at Blackadder, in Berwickshire. Readings of —8° were registered at Thirlestane Castle, —5° at Haddington, Kelso, Melrose, Wolflee, and Corbridge-on-Tyne, —4° at Alston, and —0°·8 at Braemar. Temperatures below 10° were registered over the south and south-east of Scotland, and over the north of England as far as the valley of the Trent, while over almost the whole of England, Scotland, and Ireland the temperature fell below 20°. In some parts of the south of Scotland, and in the border counties, the maximum temperature during the day did not rise to 20°.

On the 5th, the cold generally was not so intense as on the previous day, as in many localities the sky was cloudy, and snow fell: at some places, however, very low minimum temperatures were registered, viz.;—13° at Blackadder, —2° at Alston, and —1° at Thirlestane Castle. In Ireland this was the coldest day of the month, the temperature falling to 9° at Colebrooke Park, and 9°·8 at Birr Castle.

On the 6th the temperature fell considerably in Derbyshire, Nottinghamshire, and Yorkshire: readings of —3° being recorded at Trent College, —1°·0 at Buxton, and 0° at York and Stanley. At many places the maximum temperature during the day was much below the freezing point.

On the 7th very low temperatures were registered over the whole of the north and east of England; the lowest reported was —10° at Ketton, near Stamford. Some of the other low readings were —5°·8 at Worksop, —5°·5 at Audley End and Melrose, —4°·7 at Appleby, —4°·5 at Coston, —3°·8 at Buxton, — 3° at Trent College and Much Hadham, —2° at Nottingham, and —0°·4 at Saffron Walden. It will thus be seen that the temperature fell below zero in the counties of Essex, Leicester, Derby, Lincoln, Nottingham, and York, and also in the south of Scotland, while over almost the whole of the north-east and central part of England, as well as a portion of the south-eastern district, the temperature fell to 10° or below. Readings below 20° prevailed over nearly the whole of England and Scotland, and the centre of Ireland. At a few places the maximum temperature during the day was extremely low, the thermometer at Appleby only recording 12°·4, and that at York 18°.

During the next few days a little warmer weather prevailed, but on the 11th the temperature fell below 10° in the south-east of Scotland and the east of England, the lowest readings being 3° at Blackadder, 8° at Ketton, 9° at Wolflee, 9°·2 at Audley End, and 9°·9 at Coston. Temperatures below 20° were registered over almost the whole of Scotland, the greater part of England, and the centre of Ireland. Low temperatures were also experienced at most places on the 12th. Milder weather continued for the next few days, but on the 17th the temperature again fell below 20° over the whole of the south of England, the lowest readings being 11°·8 at Folkestone, 15°·7 at Tunbridge, 17°·4 at Swarraton, 17°·5 at Netley and Salisbury. Low temperatures also prevailed on the 18th, 21st, 23rd, 24th, and 26th, whilst the maximum temperatures at many places on the 21st and 26th did not reach 32°.

The accompanying table (p. 106) gives the lowest temperature registered at each station, and the date on which it occurred, the number of days the minimum temperature fell below 32° and 20° respectively, and the mean maximum and minimum temperatures for the month. Columns are added showing the time at which the thermometers were read, the form of stand used, whether the instruments were verified or not, and the height above sea level. From the table we learn that at almost all the English inland stations frost occurred on an average of about 25 days during the month, and that temperatures below 20° were registered from 8 to 13 days at several places. Scilly was the only station where frost was not felt, the lowest temperature recorded being 33° on the 2nd. The mean isothermal lines for the month of December 1879 are given on chart 7 (Plate VI.), from which it will be seen that over the south-east of Scotland and east of England the mean temperature for the month did not exceed 30°; while over almost the whole of the inland district of England and the south of Scotland the mean was below the

freezing point. The only comparatively mild districts were the west and south of Ireland and the extreme south-west of England. Even the sea-side health resorts, which are reputed for their mild climates, were not exempt from the cold, the temperature falling below the freezing point on 11 occasions at Ventnor, 15 at Torquay, 19 at Bournemouth and St. Leonard's, 20 at Sidmouth and Eastbourne, and 24 at Ramsgate and Worthing.

On chart 8 (Plate VI.) are given the average isotherms over the British Isles for the month of December, as prepared by Mr. Buchan from 13 years' observations (1857-69).* A mere glance at charts 7 and 8 will suffice to show the abnormal character of the temperature of December 1879.

An inspection of the Daily Weather Charts will show that during the time of cold weather the atmospheric pressure was very high over these islands, and that an anticyclone was formed over those districts where the lowest temperatures were recorded. Mr. Abercromby, in his paper "On the general character and principal sources of variation in the weather at any part of a cyclone or anticyclone," says: "In anticyclones, viewed on a synoptic chart, the position of blue sky, cloud and fog seems very capricious, but to a single observer a certain general character is readily perceptible. In a general way the weather is fine, or at least quiet; and though, in the calm centre especially, thick fogs are often found, and cloud in other parts, the surroundings are so different that they can rarely be mistaken for cyclone weather. There is always a certain coolness in the air, though if the sun shines it is very hot; in fact, the terms 'radiation weather' and 'radiation temperature' would generally best describe anticyclone weather."† There is no doubt that the intense cold of December last was due to the "radiation weather" which accompanied the anticyclones. But why was the atmospheric pressure so high and persistent over the British Isles, instead of the normal conditions prevailing? This I must leave to others to investigate.

That the cold was the result chiefly of radiation is shown by the great difference in temperature at the hill and valley stations. For instance, at Farley, 688 feet above sea level, 17°·7 was registered on the 7th, while at Oakamoor, nearly 300 feet lower, in the valley of the Churnet, and less than a mile distant from Farley, the temperature fell to 1°·1. Precisely the same thing occurred at the Heath House, Cheadle, and the Vicarage, Tean, which are only three-quarters of a mile apart, where the readings were respectively 18°·0 and 2°·0.

The effect of the cold upon the health of the community was very great. In London the number of deaths referred to diseases of the respiratory organs increased to 799 in the week ending December 20th, and exceeded the weekly average by 288. (See Table on page 110).

The public journals record the fact that many persons were frozen to death in various parts of the country. The frost also caused great injury to plants and shrubs. Mr. Wemyss, of Springwood Park, Kelso, says that the low temperature has killed many shrubs, even hollies; and one that can be little

* Journal of the Scottish Meteorological Society, Vol. III., p. 102.

† Quarterly Journal, Vol. IV., p. 8.

Station.	Authority.	Minimum Temperature. Absolute.	Date.	No. of times. Below 32°.	Below 20°.	Means. Maximum.	Minimum.	Time of Reading.	Stand.	Thers. verified.	Height above Sea Level.
SCOTLAND.		°				°	°				ft.
Sumburgh Head	D. W. R.	23	5	7	0	43·5	35·3	8 a.	S.	v.	110
Sandwick	Rev. Dr. Clouston	21·8	4	8	0	44·2	36·1	9 a.	W.	v.	94
Stornoway	G. Macdonald	24	3	8	0	44·0	35·5	9 a.	S.	v.	100
Dunvegan	R. Mackintosh	12	1	10	3	45·7	33·5	9 p.	S.	v.	24
Wick	D. W. R.	15	3	12	4	42·4	30·8	8 a.	S.	v.	76
Dunrobin	D. Melville	20·5	2	18	0	43·2	32·3	9 p.	S.	v.	12
Lairg	W. Ross	4	3	20	10	38·2	25·6	9 p.	S.	v.	460
Beauly	W. C. Preston	11	2	..	..	..	..	9 a.	..	n.	125
Culloden	D. Forbes	16·5	3	13	2	40·7	33·1	9 p.	S.	v.	104
Nairn	D. W. R.	14	3	13	2	41·4	32·2	8 a.	S.	v.	84
Newpitsligo	D. Sturrock	14·9	4	22	2	..	27·9	9 p.	S.	v.	495
Aberdeen	D. W. R.	15	3, 5	17	3	40·8	28·7	8 a.	S.	v.	96
Aberdeen	Rev. Dr. Beverley	14·6	3	19	3	40·3	29·0	9 a.	..	v.	84
Braemar	J. Aitken	— 0·8	3, 4	21	10	39·3	24·7	9 p.	S.	v.	1114
Roy Bridge	A. Fraser	11	3	16	6	41·2	28·9	9 p.	S.	v.	310
Laudale (Loch Sunart)	A. Fletcher	18·4	2	..	..	..	..	..	S.	v.	..
Montrose	J. Malcolm	10	4	19	3	38·1	28·0	9 p.	S.	v.	200
Perth	J. Moncur	7	4	20	9	40·6	26·3	9 a.	S.	v.	34
Glenalmond	Rev. Dr. Robinson	10·0	4	20	4	39·4	28·1	9 p.	S.	v.	533
Kembach, Fife	J. Makgill	7	4, 5	..	..	..	..	9 a.	W.	v.	98
Stronvar	J. Dickson	7	4	18	10	40·0	27·1	9 p.	S.	v.	422
Eallabus (Islay)	J. R. Ballingall	16·4	4	..	2	..	..	9 p.	S.	v.	71
Rothesay	J. Kay	18·5	4	11	1	43·8	33·3	9 p.	S.	v.	116
Ardrossan	D. W. R.	15	4	14	2	43·1	33·3	8 a.	S.	v.	14
Annanhill (Kilmarnock)	W. H. Dunlop	10·0	4	15	4	43·0	30·3	9 a.	S.	v.	170
Glasgow	Prof. R. Grant, F.R.S.	14·6	4	13	2	40·8	32·3	10 p.	W.	v.	190
Cambuslang	Dr. Muirhead	7	4	19	8	38·5	28·3	9 a.	P.	..	146
Ridge Park	C. Lindsay	2	4	20	6	40·0	26·4	9 a.	S.	v.	630
Leith	D. W. R.	7	4	18	3	42·9	29·5	8 a.	S.	v.	22
Haddington	C. J. Dods	— 5	4	..	..	..	..	8.30 a.	W.	n.	140
Thirlestane Castle	J. Whitton	— 8	4	25	13	37·4	20·1	9 p.	S.	v.	555
Melrose	A. B. Dodds	— 5·5	7	25	14	36·7	19·3	9 p.	..	..	280
Blackadder	J. Reid	—23	4	24	14	36·0	18·3	9 a.	W.	n.	..
Kelso	G. Wemyss	—16	3	23	13	36·7	20·3	9 a.	S.	v.	130
Milne-Graden	W. Renwick	— 3	4	22	9	37·5	24·8	9 p.	S.	v.	103
Wolflee	D. M'Pherson	— 5	4	22	11	38·5	22·9	9 p.	S.	v.	601
Drumlanrig	D. Thomson	1	6	23	12	38·4	23·0	9 p.	S.	v.	191
Dumfries	A. Bruce	8	4, 6	22	11	41·2	24·6	9 p.	S.	v.	159
Cally	J. Wood	14	4	14	2	41·5	31·1	9 p.	S.	v.	140
Portpatrick	Dr. Urquhart	20	4	10	0	44·1	35·9	9 p.	S.	v.	30
ENGLAND.											
Alnwick	F. Holland	3	4	20	4	39·5	28·6	10 a.	..	v.	182
Corbridge-on-Tyne	T. Hurst, Jun.	— 5	4	20	6	37·3	25·9	9 a.	..	v.	270
Shields	D. W. R.	10	4	19	4	41·2	29·3	8 a.	S.	v.	98
Stapleton	T. H. Walker	4	4, 5	..	..	..	..	9 a.	S.	n.	400
Scaleby	R. A. Allison	3·0	4	21	10	38·6	25·5	9 p.	S.	v.	111
Dalston	Rev. E. Carr	4·5	4	20	9	39·7	26·7	9 p.	S.	v.	164
Silloth	Rev. F. Redford	8·0	4	18	7	39·2	27·7	9 p.	S.	v.	29
Cockermouth	Dr. H. Dodgson	9·8	4	19	7	39·6	29·0	9 p.	S.	v.	344
Alston	T. W. Dickinson	— 4	4	22	12	39·2	22·5	9 a.	S.	n.	1145
Gainford	A. Atkinson (late)	— 2·0	3	..	..	..	..	9 a.	S.	v.	255
Durham	G. A. Goldney	4·4	4	23	7	39·6	25·9	10 p.	S.	v.	340
Aysgarth	Rev. F. W. Stow	2·7	7	22	6	37·4	25·6	9 p.	S.	v.	660
Scarborough	F. Shaw	19·5	2	15	1	39·8	30·9	9 p.	S.	v.	115
York	J. Wright	0	6	21	10	37·0	24·6	9 p.	S.	v.	55
Hull	Rev. Dr. Mackay	10·0	7	19	6	37·7	27·1	9 p.	S.	v.	4

Station.	Authority.	Minimum Temperature. Absolute.	Date.	No. of times. Below 32.°	Below 20.°	Means. Maximum.	Minimum.	Time of Reading.	Stand.	Thers. verified.	Height above Sea Level.
ENGLAND.		°				°	°				ft.
The Park	E. Peak	7	7	21	8	37.5	25.5	9 p.	W.	v.	4
Head	D. W. R.	25	..	..	..	40.1	..	8 a.	S.	v.	28
gholme	Rev. J. Byron	10.5	7	19	7	..	27.5	9 a.	W.	n.	60
oy	Rev. J. E. Cross	— 4.7	7	26	9	34.9	23.3	10 a.	..	v.	50
rn	D. G. Briggs	5.8	7	26	7	36.4	25.3	9 p.	S.	v.	388
astle	W. Carter	0.0	7	21	8	35.7	24.3	4 p.	W.	v.	..
ck (Worksop)	H. Mellish	— 5.8	7	23	9	38.9	22.8	9 a.	S.	v.	55
ld	W. F. Cooper	3.0	7	23	6	39.5	26.1	11 p.	..	v.	260
ield	H. Clarke	0.0	7	21	8	40.3	25.0	9 p.	S.	v.	96
y	Rev. R. Burrell	0	7	..	..	38.7	..	8.30 a.	..	n.	100
ng	S. King	5	4	24	10	36.4	25.0	..	S	v.	55
hurst	Rev. S. J. Perry, F.R.S.	12.9	7	19	5	37.5	28.2	10 p.	W.	v.	382
ool	C. T. Ward	4	5	25	6	39.4	25.8	9 a.	..	n.	30
urn	W. B. Bryan	11.5	5	25	8	38.5	25.7	9 a.	..	v.	..
	Rev. T. Mackereth	13.5	7	29	9	39.1	23.5	9 a.	S.	v.	481
ich	H. R. O. Sankey	16.7	7	24	3	38.4	27.9	9 p.	S.	v.	294
a	E J. Sykes	— 3.8	7	25	9	38.1	23.1	9 p.	S.	v.	990
	J. Hunter, Jun.	5.0	7	27	7	37.4	25.1	9 a.	W.	n.	344
	C. L. Wragge	17.0	5	24	4	38.3	28.0	9 p.	S.	v.	638
moor	C. L. Wragge	1.1	7	25	7	36.7	24.2	9 p.	S.	v.	350
le	J. C. Philips	17.6	5	24	3	38.1	28.2	9 p.	S.	v.	646
	Rev. G. T. Ryves	2	7	23	6	38.6	26.1	9 a.	G.	n.	470
eld	W. Tyrer	3.7	7	25	7	37.0	25.0	9 p.	S.	v.	349
gham	D. W. R.	— 2	8	24	9	37.6	23.8	8 a.	L.	v.	180
-on-Trent	Rev. C. U. Tripp	5	7	25	8	36.7	25.3	9 a.	..	v.	160
College	Rev. C. U. Tripp	— 3	6	26	13	37.6	22.6	9 a.	..	v.	120
borough	W. Berridge	1.5	2, 8	23	11	37.8	23.2	8 a.	S.	v.	169
	Rev. A. M. Randell	— 4.5	2	25	10	36.1	22.6	9 a.	S.	n.	300
ter	W. J. Harrison	3.0	2	24	7	37.2	25.8	9 p.	S.	v.	237
	F. Coventry	—10	7	..	..	..	..	9 a.	W.	n.	130
gham	Rev. G. H. Mullins	15.5	2	25	4	37.0	27.1	9 p.	S.	v.	484
gham (Oscott)	Rev. S. Whitty	7.1	7	24	5	38.1	27.2	..	S.	v.	460
ry	J. Gulson	5	7	27	8	38.4	24.2	9 a.	W.	n.	288
	Rev. T. N. Hutchinson	3.2	7	26	8	36.3	25.0	9 p.	S.	v.	..
mpton	H. Terry	11	6	..	..	..	..	9 a.	W.	n.	253
gton	Rev. H. Ffolkes	5.2	7	25	10	35.9	24.0	9 p.	S.	v.	88
ath	D. W. R.	15	7, 8	26	2	37.2	27.0	8 a.	S.	v.	10
oft	S. H. Miller	13.8	7	24	2	37.5	27.7	9 p.	S.	v.	85
eyton	Rev. C. J. Steward	10.0	7	24	4	..	25.7	9 a.	G.	v.	50
ton (Beccles)	E. T. Dowson	11.0	2	24	4	37.3	26.4	9 p.	S.	v.	40
(Norwich)	H. Culley	3.5	7	24	8	37.3	23.4	9 a.	W.	v.	40
dge	D. W. R.	0	7, 8	26	9	38.1	23.0	8 a.	S.	v.	90
End	W. Harrison	— 5.5	7	27	8	..	22.8	9 p.	S.	v.	154
Walden	J. G. Bellingham	— 0.4	7	26	7	..	24.4	9 p.	S.	v.	170
ng	Rev. E. Hill	1	7	26	5	36.1	24.7	9 a.	W.	n.	226
	H. Hunting	0	7	28	6	36.8	23.8	9 a.	B.	v.	273
Hadham	Rev. H. S. Mott	— 3	7	..	..	..	..	9 a.	W.	n.	200
gton	J. McLaren	2.0	7	28	9	37.1	23.2	9 a.	G.	n.	109
ton	J. Mathison	5	7	27	6	37.2	24.6	9 a.	S.	n.	309
Guise (Woburn)	E. E. Dymond	10.4	7	25	6	37.8	25.3	10 a.	S.	v.	433
mpstead	W. Squire	7	7	26	5	36.5	25.1	9 a.	G.	v.	370
a	H. Wortham	11.6	7	..	..	..	..	10 a.	G.	n.	274
den	T. Wilson	5.4	7	25	6	36.0	25.1	9 p.	S.	v.	380
d	J. Hopkinson	7.6	7, 8	..	..	..	..	9 a.	S.	v.	225
Hatch	J. Thrustans	6.8	7	25	5	37.7	26.2	9 a.	..	v.	150
ll Row	J. Campbell	13.1	7	25	3	37.4	26.7	9 p.	S.	v.	186

Station.	Authority.	Minimum Temperature. Absolute.	Date.	No. of times. Below 32°.	No. of times. Below 20°.	Means. Maximum.	Means. Minimum.	Time of Reading.	Stand.	Thers. verified.	Height above Sea Level.
ENGLAND.		°				°	°				ft.
Enfield	T. Paulin	7·9	7	26	4	35·0	25·2	9 a.	..	v.	250
Hackney	Dr. Tripe	11·4	7	24	3	38·1	27·3	9 a.	S.	v.	59
Regent's Park	W. Sowerby	14·0	7	24	4	36·4	27·1	9 a.	G.	v.	126
Camden Square	G. J. Symons, F.R.S.	16·1	7	24	4	37·7	26·9	9 p.	G.	v.	111
Greenwich	Sir G. B. Airy, F.R.S.	13·7	7	24	4	37·4	26·8	12 p.	G.	v.	155
Eltham	E. J. C. Smith	7·7	2	25	4	36·8	25·9	9 p.	S.	n.	80
Norwood	W. Marriott	13·8	2, 7	25	5	37·2	26·5	9 p.	S.	v.	184
Croydon	E. Mawley	13·6	7	25	5	37·6	26·0	9 p.	S.	v.	201
Isleworth	Miss E. A. Ormerod	11·5	7	..	..	..	..	9 a.	S.	v.	68
Kew	G. M. Whipple, B.Sc.	13·0	7	26	4	37·5	27·1	10 p.	W.	v.	30
Cooper's Hill	Prof. H. McLeod	16·3	7	26	7	37·4	25·6	9 a.	S.	v.	279
Streatley	Rev. J. Slatter	13·0	7	24	7	39·2	26·0	9 a.	J.	v.	150
Strathfield Turgiss	Rev. C. H. Griffith	10·3	7	26	8	37·3	24·7	9 p.	S.	v.	195
Swarraton	Rev. W. L. W. Eyre	9·0	7	..	..	..	..	9 a.	S.	v.	310
Liverpool	A. R. Andersson	15·0	4	..	3	..	..	8 a.	S.	n.	123
Bidston	D. W. R.	22	2, 4	19	0	41·1	30·8	8 a.	S.	v.	180
Hinderton	R. Bushell	19·5	4	21	1	40·5	30·0	8 a.	S	v.	218
Chester	A. O. Walker	16·4	5	21	3	39·9	29·6	9 a.	S.	v	64
Colwyn Bay	A. O. Walker	20	4	12	0	43·6	32·7	9 a.	S.	n.	180
Llandudno	Dr. J. Nicol	23·0	4, 5	10	0	44·2	34·1	9 p.	S.	v.	79
Holyhead	D. W. R.	28	4, 5	4	0	44·9	36·8	8 a.	S.	v.	44
Sansaw	F. G. Tippinge	18	4	19	3	38·5	29·2	9 a.	..	v.	311
Leaton	Rev. E. V. Pigott	11·9	2, 4	23	6	38·8	26·6	9 p.	S.	v.	266
Stokesay	Rev. J. D. La Touche	13·0	7	24	6	39·2	27·3	9 p.	S.	v.	369
Churchstoke	P. Wright	15·2	2	23	5	40·1	27·9	9 p.	S.	v.	549
Hereford	Dr. T. A. Chapman	13·5	7	24	5	40·4	26·8	9 a.	S.	v.	275
Ross	H. Southall	13·8	7	25	6	39·4	26·7	9 a.	S.	v.	213
Aberystwith	M. Jones	20	4	..	..	..	..	9 a.	S.	n.	45
Carmarthen	Dr. G. J. Hearder	17·9	5	20	1	43·0	28·9	9 p.	S.	v.	188
St. Ann's Head	D. W. R.	26	4, 5	7	0	..	36·3	8 a.	S.	v.	150
St. David's	W. P. Propert, LL.D.	21·6	4	14	0	43·2	34·4	9 p.	S.	v.	189
Cardiff	W. Adams	19·2	7	22	2	39·6	28·5	9 a.	..	..	43
Llanfrechfa	F. J. Mitchell	20	7	23	0	..	28·0	9 a.	W.	v.	320
Cheltenham	R. Tyrer	11·2	1	26	6	38·5	24·8	9 p.	S.	v.	184
Broughton	E. C. Morrell (late)	7·6	7	25	6	37·0	25·9	9 a.	P.	v.	442
Oxford	E. J. Stone, F.R.S.	12	7, 8	24	6	38·5	25·7	8 a.	S.	v.	210
Cirencester	Prof. H. Ohm	14	2, 7	26	7	37·8	25·0	..	..	..	..
Marlborough	Rev. T. A. Preston	13·4	7	27	6	38·7	26·4	9 p.	S.	v.	471
Compton Bassett	J. Allen	13	7	..	..	..	..	9 a.	..	v.	400
Salisbury	T. Challis	10·0	7	28	11	38·7	23·4	9 a.	G.	v.	186
			2								
Holt	Major F. B. Gritton	12·2	2	21	6	37·8	26·9	9 p.	S.	v.	120
Downside	Rev. T. L. Almond	12·6	2	25	4	38·9	26·5	9 p.	S.	v.	592
Barnstaple	W. Knill	21	5	19	0	42·0	30·4	..	S.	v.	43
Helston	M. P. Moyle	25	1, 4	11	0	48·0	34·3	9 p.	..	n.	160
Altarnon	Rev. J. Power	10	2	20	5	41·4	26·7	9 a.	..	v.	570
Cosgarne, St. Austell	C. Truscott, Jun.	18·2	5	16	2	45·6	32·5	9 a.	S.	v.	191
Falmouth	L. Squire	27·7	5	2	0	45·0	38·6	10 p.	W.	v.	200
Maker	Rev. P. H. Newnham	22·6	5	14	0	43·9	33·5	9 a.	S.	v.	290
Plymouth	J. Merrifield, LL.D.	20·8	5	20	0	43·2	31·0	..	S.	v.	73
Dartmoor, Prince Town	W. H. Tooker	18·0	2	27	3	37·4	26·6	9 p.	S.	v.	1350
Prawle Point	D. W. R.	21	5	8	0	44·6	34·5	8 a.	S.	v.	330
Torquay, Castle College	C. J. Harland	22·6	5	19	0	43·6	31·3	9 a.	S.	v.	166
Torquay, Rocombe	H. Hearder	23·7	5	15	0	43·0	32·7	9 p.	S.	v	400
Babbacombe	E. E. Glyde	22·8	13	15	0	42·8	32·1	9 p.	S.	v.	293
Teignmouth	G. W. Ormerod	21·3	5	21	0	44·1	29·8	9 a.	S.	v.	235
Sidmouth	Dr. Radford	21	5	20	0	42·7	31·3	9 a.	S.	v.	186

Station.	Authority.	Minimum Temperature. Absolute.	Minimum Temperature. Date.	No. of times. Below 32°.	No. of times. Below 20°.	Means. Maximum.	Means. Minimum.	Time of Reading.	Stand.	Thers. verified.	Height above Sea Level.
ENGLAND.		°				°	°				ft.
uth	Rev. C. H. Gosset	18	5	20	1	40.4	30.3	9 a.	W.	n.	200
mouth	Adm. Sir J. Sulivan	19.0	7	19	1	39.7	29.3	10 a.	G.	v.	130
Bourne	Dr. T. A. Compton	16.8	5	22	3	39.9	28.1	9 p.	S.	v.	90
Castle	D. W. R.	22	17	21	0	40.0	29.4	8 a.	S.	v.	14
m	F. Ekless	13.5	7	..	5	..	..	9 a.	..	v.	85
r	Rev. C. Malden	22	5	11	0	41.3	33.5	9 a.	W.	v.	75
	Dr. deChaumont, F.R.S	15.0	7	23	5	41.9	26.2	9 p.	S.	v.	37
mpton, O.S.D.	Col. R. E. Cooke, F.R.S.	17.0	7	24	1	39.2	27.9	9 p.	S.	v.	74
mpton	Rev. H. Garrett	14.7	7	24	7	39.1	26.3	9 p.	S.	v.	140
ng	W. J. Harris	20.4	17	24	0	40.3	29.6	9 p.	S.	v.	21
d's Heath	Rev. T. E. Crallan	16.3	7	25	4	38.9	26.8	9 a.	P.	v.	250
rough Beacon	C. L. Prince	17.6	17	26	3	36.9	27.5	9 a.	S.	v.	776
urne	S. Bretton	19.0	17	20	1	39.9	29.5	9 p.	S.	v.	24
nard's	H. Colborne	17.6	17	19	1	38.9	30.2	9 p.	S.	v.	116
s	A. E. Murray	17.6	17	21	1	38.5	29.2	9 p.	S.	v.	172
lge	W. C. Punnett	9.4	2, 3	26	7	36.6	24.7	9 p.	S.	v.	99
en	J. E. Mace, Jun.	18	7, 17	26	3	35.9	26.9	9 a.	W.	n.	196
n	Major Lambert, R.E.	14.7	7	..	..	38.8	..	9 p.	S.	v.	135
one	A. H. Taylor	11.8	17	..	..	..	..	9 a.	S.	v.	..
	D. W. R.	18	17	22	1	38.2	29.1	8 a.	W.	v.	30
te	Rev. E. T. Egan	20.9	7	24	0	38.1	27.9	9 p.	S.	v.	105
RELAND.											
lerry	J. Conroy	16.0	4	15	3	41.7	31.1	9 p.	S.	v.	93
a	T. Colquhoun	20	3	11	0	46.7	33.2	9 a.	W.	n.	20
adee	D. W. R.	20	5	10	0	43.9	33.4	8 a.	S.	v.	37
town	T. Waring	12	4	15	8	41.2	28.6	..	J.	v.	191
	L. Turtle	14	5	17	8	39.7	28.6	9 a.	S.	v.	110
	S. Call	17.6	2	14	4	39.9	30.8	10 p.	W.	v.	206
O.S.O.	Col. C. N. Martin	16.2	2	19	6	44.0	28.6	9 p.	S.	v.	162
	Dr. J. W. Moore	21.8	5	15	0	42.9	32.9	9 p.	S.	v.	51
wn	D. W. R.	23	3, 5	12	0	45.7	33.9	8 a.	S.	v.	22
	Sir N. Staples	19	2	20	9	42.4	26.4	9 a.	S.	v.	305
ke Park	M. Ferguson	9.0	5	16	6	41.3	27.8	9 p.	S.	v.	230
Castle	E. Salles	16.0	2	18	2	42.7	29.8	9 p.	S.	v.	132
more	D. W. R.	28	5	5	0	46.2	35.9	8 a.	S.	v.	36
	J. Hodson	12	5	17	6	40.3	29.2	9 a.	W.	n.	186
oe	W. H. Kempster	12	5	17	4	40.0	28.6	9 a.	W.	n.	161
tle	W. Harding	9.8	5	16	5	42.8	29.3	9 p.	S.	v.	186
	J. E. Cullum	29.1	4	4	0	49.5	39.7	10 p.	W.	v.	20
a, Waterford	J. Neale	14.5	5	16	1	44.0	32.4	9 p.	..	v.	55
Point	D. W. R.	26	2, 5	7	0	46.5	37.1	8 a.	S.	v.	37
	A. W. Moore	19.0	5	17	1	44.8	32.8	9 p.	S.	v.	137
	D. W. R.	33	2	0	0	47.9	41.3	8 a.	S.	v.	80
,	Dr. Hoskins, F.R.S.	25	4	12	0	44.0	33.0	9 a.	G.	v.	204
Millbrook	P. Langlois	22.0	3	23	0	42.5	30.4	9 p.	S.	v.	50
t. Aubin's	J. E. Vibert	22.7	3	16	0	42.4	32.6	9 p.	S.	v.	139

W. R indicates Daily Weather Report; B. Barrow, G. Glaisher, J. James, L. Lawson, P. Pastorelli, S. Stevenson, W. Wall Screen : v. verified, and n. not verified. The height above Mean Sea Level is that of the ground under the thermometers.

Deaths.	Diseases of the Respiratory Organs.	Difference from Average.	Bronchitis.	Pneumonia.
Week ending Nov 29.	576	+ 89	373	153
" " Dec. 6.	612	+135	414	135
" " " 13.	777	+275	559	149
" " " 20.	799	+288	549	167
" " " 27.	652	+128	447	125

short of 100 years old has been killed. Mr. Mellish, of Hodsock, near Worksop, writes :—" Very nearly every laurel, Portugal laurel and evergreen oak has been killed to the ground. The hollies have all lost their leaves; most of the common variety will, I think, recover, but many others are, I believe, quite dead. The holly berries were turned quite black by the cold, I suppose because they were so late and had not properly ripened. Many roses that were not covered up have been killed. Deodaras seem to have been all killed, except perhaps a few small ones lately planted. Pinsapos have also suffered."

In marked contrast to the above it may be mentioned that Dr. Radford says that 4 roses, half opened, were gathered from 4 different trees in one garden at Sidmouth on Christmas Eve.

With regard to birds, Mr. T. Hurst, Jun., of Lauder Grange, Corbridge-on-Tyne, writes :—" December 2nd: A robin was picked up in the porch quite benumbed with cold, but soon revived on being brought into a warm room. 13th: A robin took shelter in the house all yesterday, but there are scarcely any birds to be seen now. 29th: There is a marked scarcity of birds this winter."

Mr. Mellish says :—" As regards birds I did not notice that they suffered so much as in the long continued frost of 1878-9, partly perhaps because they were not so abundant. I do not think that fieldfares were as scarce as seems to have been the case in many places from accounts in the papers; though not so numerous as last year, still I saw some considerable flocks. Redwings were perhaps rather scarce, but blackbirds were numerous."

The Rev. R. Burrell, of Stanley, near Wakefield, reports that there were very few small birds in his parish this year, and an entire absence of the fieldfares.

Mr. Wragge, of Farley, says that redbreasts were rather scarce, in fact there were fewer birds altogether than last year. He further adds that " on the 6th the station-master at Oakamoor declared that the railway lamps were 'frozen out,' and that rabbits, pushed for food, had attacked the oil and grease on the station crane."

The River Trent was frozen over on the 2nd, and was remarkably low the whole of the month. The River Ouse at York was frozen over from the 4th to the 24th. The River Churnet was frozen over in places on the 7th.

Although the observations have not been taken at the same time—the thermometers being read at 8, 9, or 10 a.m., and 9 or 10 p.m.—and different kinds of stands for exposure have been used, still the results agree

very well indeed, much better than could have been expected. It should be mentioned, however, that none of the thermometers have been verified at the low points of the scale; in fact, very few below 32°. As this is an important matter, the Council have suggested to the Kew Committee the desirability of having the Dry, Wet, and Minimum Thermometers verified down to zero. The Committee have undertaken to consider the question, and are making experiments with a view of ascertaining the most convenient method of verifying thermometers at a temperature of zero. It may be further mentioned that the Kew Committee will, if desired, verify Dry, Wet, and Minimum Thermometers down to 12°, charging a fee of 1s. 6d. for the certificate.

Another point, to which the attention of observers should be called, is that they should provide themselves with thermometers graduated to at least 20° below zero.

Since this Paper was read I have communicated with Dr. C. Stuart (late President of the Berwickshire Naturalists' Club) respecting the remarkably low temperature at Blackadder, and asked for information on the following points:—

1. What kind of thermometer was used?
2. Was it verified?
3. Who was the maker?
4. How was it exposed and mounted?
5. When was it read?
6. Who made the observation?
7. Is it certain that no mistake was made in reading?
8. Is the ground level or hilly, open or wooded?
9. What is the nature of the soil, and height above sea-level?
10. How low is the thermometer graduated, and are the divisions on the tube or only on the frame?

Dr. Stuart's reply is as follows:—

"I have much pleasure in complying with your request to furnish further information relative to the unprecedented low temperature which we experienced in the Merse of Berwickshire in December last. In answer to your questions—

1. An upright registering thermometer.

2. Yes; with another, with the scale engraved on the tube, in the possession of Sir G. H. Boswall, which was tested at Kew; both gave the same results.

3. Lennie, of Edinburgh.

4. Northern exposure, 2 feet from the ground, with a sloping board about 2 ins. across overhead, to keep off the wet. Instrument mounted on a metal frame, painted white, a well-finished instrument.

5. Read at 9 a.m.

6. Mr. John Reid, gardener to Sir G. H. Boswall, a person who has been

accustomed to send particulars to the Scottish Meteorological Society, and keeps a regular register at Blackadder.

7. There was no mistake whatever made in the reading.

8. Level, open, with wood outside garden wall, with river Blackadder distant about 100 yards.

9. Stiff, cold clay. Height above sea level cannot give exactly, from 100 to 200 feet.

10. 30° below zero, divisions on the frame, but corresponds exactly in results with another thermometer, with divisions engraved on the tube.

"I was as incredulous as any one about the 23° below zero, until I ascertained the accuracy of the observation. When I give you a few other particulars as to other places, you will at once see that the cold was nearly as great at several other stations in the immediate neighbourhood. At Killoe House, about a mile farther up the Blackadder, the temperature was 18° below zero. Had the instrument been at the garden by the river side, the temperature recorded would have been as low as that at Blackadder. At Allanbank Garden, facing the south, on the opposite side of the river, 18° below zero was registered. This place stands well up off the river bank, and is not so exposed to the frost rinds as the other places mentioned. At Ninewells House, about a mile off on the River Whiteadder, but situated on elevated ground, 8° below zero was recorded by the gardener. At Chirnside Bridge, on the window sill, 6° below zero was observed. I have just had a call from Mr. Reid, who brings his instrument with him and the register of temperatures for December, which I enclose. Now for results:—His peach trees 60 years planted are killed to the roots. The evergreen laurels, Portugal laurels, rhododendrons, hollies in many instances, Wellingtonias, araucarias, deodar pines, all killed. I have lived 82 years in the county, and have seen many hard winters, but any such stinging low temperatures I never remember. The hollies (the common green varieties) are at present without a leaf, the young growths killed close in. Three persons in my immediate neighbourhood perished in the snow in one week. I never in 82 years had so many cases of frost bite under treatment at one time; some of a very severe nature. I think I have now given you pretty good evidence of the severe season we have passed through."

DISCUSSION.

Dr. MANN hoped that some equally interesting account of the cold period of January 1880, might be prepared for the Journal of the Society. It was a notable fact that in the neighbourhood of Wandsworth Common, the water pipes connecting the houses with the main were frozen only for a few hours on December 5th, but they were frozen hard uninterruptedly for 9 days from January 29th to February 6th, 1880. The freezing occurred on the fourth night, with an air temperature down to 19°. The pipes connecting the houses with the main are laid 32 ins. deep in the ground, but in many instances cross under sunken areas, and, therefore, a few inches of shallower earth, where they enter the houses.

Mr. STRACHAN said that he had intended investigating this very subject, but after Mr. Marriott's paper he should not proceed with it any further. During

the prevalence of the cold weather, we had been on the north-eastern edge of an anticyclone. A bank of high pressure extended over the whole of Europe as far as Russia. The connection between the high pressure and low temperature, if thoroughly worked out, would be interesting; but what was wanted was a means of foretelling these long spells of cold weather.

Mr. MAWLEY welcomed Mr. Marriott's excellent paper as containing the most complete series of severe winter temperatures that he had yet seen. He, however, considered that he would have done still better had he confined his tables exclusively to strictly comparable and reliable observations. For setting aside for a moment the fact that differences of exposure and the height of the thermometers above the ground had not unfrequently important influences upon the value of the results obtained, we had also to keep in view the considerations that all observers were unfortunately not equally trustworthy, and that it was well known that no meteorological instruments in ordinary use were so liable to get out of order as minimum thermometers. That differences in the methods of observation sometimes seriously affected the value of minima temperatures would, he thought, be evident if he quoted the lowest readings registered at Addiscombe on the night of December 2nd—one of the days included in Mr. Marriott's investigation—when a grass minimum thermometer indicated the lowest temperature that he had yet recorded, viz. 1°·9, or 30° of frost. On this remarkable night a minimum thermometer on a Glaisher stand registered 10°·5, while another in a Stevenson screen, close by, indicated only 16°·8, or 6°·3 higher than the one on the Glaisher stand. Both thermometers were verified instruments, were suspended at precisely the same height above the same grass-plot, and only a few feet apart. Moreover the one in the Stevenson screen had a forked bulb, whereas the bulb of that on the Glaisher stand was spherical and rather larger than those now usually made. The latter therefore was the less sensitive of the two. The wide discrepancy in the indications of these 2 instruments would, he thought, serve to show how careful observers ought to be in quoting extremely low temperatures, when not registered in a closed screen, and to state the precise conditions under which they had been obtained.

Dr. TRIPE hoped that the temperatures recorded in Mr. Marriott's paper would not be deemed sufficient data on which to base a comparison as to the winter climate of these localities. He instanced the pamphlet published last year on the winter climate of Bournemouth, in which it was assumed that because the minimum temperatures recorded at that place in December 1878 were not so low as at many other sea-side and inland health resorts, that therefore the winter at Bournemouth was warmer than at other localities. This was an error, as an examination of the records for January 1879 showed an almost complete reversal of the temperature at Bournemouth as compared with several other stations, and the same occurred in December 1879. Mr. Marriott's paper showed, however, that many inland and sea-side places had suffered in a similar way in December 1879 as they did in 1878. Dr Tripe quoted the figures given in the Registrar General's Quarterly Reports in support of his statement.

Mr. SOUTHALL said that the temperature in Herefordshire was lower in December 1878 than in 1879. This he attributed to the absence of snow.

Mr. LAUGHTON called attention to the apparent effect of the hills along the south coast on the isotherms. So far as could be seen on a map of so small a scale, the isotherm of 20° followed the line of the South Downs with great exactitude. Speaking from personal knowledge, he could say that there was a well-marked difference of climate between Portsmouth on the south, and Horndean, about 10 miles off, on the north of the hills.

Mr. WHIPPLE inquired how it was that the River Thames was not frozen over, when the whole valley through which it ran had a mean temperature below the freezing point for the month? He did not think the conditions had changed much above Teddington locks since the winter of 1855-6, when he had witnessed the roasting of sheep on the ice.

Mr. BALDWIN LATHAM said that in all probability the reason why the River Thames was not frozen over during the last winter, or to the extent it had been frozen in the previous winter, was due to the unusual amount of warm spring water in the river, which, as it issued from the ground, had a temperature of about 50°. At the end of the year 1879 the volume of the springs was about double that of any of the previous 4 years at the same period, and as during the

months of October, November and December, the amount of rainfall had been short, the volume of cold surface water flowing off the land into the Thames had been comparatively small, so that the conditions were favourable to maintaining a higher temperature than usual in the water of the Thames during the past winter months.

The PRESIDENT (Mr. Symons) said that the readings of the earth thermometers would show why the water-pipes were not frozen so long in December as in January. With respect to the temperature of —23°, he was inclined to believe that it was correct, for it was supported by a reading of —16° at Kelso, and other readings below zero in the neighbourhood.

Mr. MARRIOTT said that full particulars as to the form of thermometer stand used, the time of reading, whether the thermometers were verified or unverified, and the height above sea level, were given in the Table. On the chart of average isotherms the temperature was corrected for elevation, but on the chart for December 1879 it was impossible to apply corrections for altitude, as the ordinary conditions were reversed, the temperature being highest at the elevated stations, and lowest in the valleys. The frost had also been very intense on the Continent. Col. Ward, writing from Rossinières, on February 14th, said: "The frost commenced on November 25th, and has continued till the present time; the only day the minimum was above 32° being January 1st, 1880 (34°·0). During this time the whole of the Oberland and its valleys have enjoyed almost uninterrupted sunshine, whilst the lake districts and valleys adjoining have been enveloped in dense fog. At Geneva the sun has not been seen since November. In this valley and all the high lands there have been during the 80 days, 68 of sunshine, and 58 absolutely cloudless, the sky being intensely blue and clear. The planet Venus has been visible all day to the naked eye from October 23rd to this day. The air was absolutely calm, except on January 5th, when a violent gale was raging on the lake. No one remembers a winter like it for length and severity, or for calm and sunshine, since 1829-30. The River Sarine, a rapid mountain river, is frozen into vast blocks of ice. I have crossed the mountains 9 times during the frost, and have ascended 7,000 ft. I never before have seen the view so clear or so extensive. I have gone through the fog which hung over the lake, and found it very dense, and about 500 ft. thick, and perfectly flat at the top and bottom. The frost still continues."

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

JANUARY 21st, 1880.

Annual General Meeting.

CHARLES GREAVES, M.Inst.C.E., F.G.S., President, in the Chair.

Mr. T. W. BAKER and Mr. W. C. PUNNETT were appointed Scrutineers of the Ballot for Officers and Council.

Dr. TRIPE read the Report of the Council and the Financial Statement for the past year. (p. 60.)

It was proposed by the PRESIDENT, seconded by Mr. EATON, and resolved:—"That the Report of the Council be received and adopted, and printed in the Society's Journal."

It was proposed by Dr. TRIPE, seconded by Mr. SILVER, and resolved:—"That the best thanks of the Meteorological Society be communicated to the Council of the Institution of Civil Engineers, for having granted the Society free permission to hold its meetings in the rooms of the Institution."

It was proposed by Mr. SCOTT, seconded by Mr. SYMONS, and resolved:—"That the thanks of the Society be given to the President for the ability and courtesy displayed by him in the Chair during his term of office."

It was proposed by Mr. DINES, seconded by Mr. BEAUFORT, and resolved:— "That the thanks of the Society be given to the Officers and other Members of the Council for their services during the year."

It was proposed by Mr. MAWLEY, seconded by Mr. PEARSE, and resolved:— "That the thanks of the Society be given to the standing Committees and to the Auditors, and that the Committees be requested to continue their duties till the next Council Meeting."

The President then delivered his Address. (p. 55.)

It was proposed by Mr. LATHAM, seconded by Mr. GASTER, and resolved:— "That the thanks of the Society be given to the President for his Address, and that he be requested to allow it to be printed in the Society's Journal."

The Scrutineers reported the result of the Ballot, and declared the following gentlemen to be the Officers and Council for the ensuing year:—

President.

GEORGE JAMES SYMONS, F.R.S.

Vice-Presidents.

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Mr. GREAVES having left the Chair, it was taken by the newly elected President, Mr. SYMONS, who thanked the Society for the honour they had done him in electing him to that Office.

The Meeting was then adjourned.

FEBRUARY 18th, 1880.

Ordinary Meeting.

GEORGE JAMES SYMONS, F.R.S., President, in the Chair.

JAMES SPOTTISWOODE CAMERON, M.D., B.Sc., Huddersfield;
FRANCIS EDWARD CAREY, M.D., Villa Carey, Guernsey;
JOHN BARFF CHARLESWORTH, Hatfield Hall, Wakefield;
ADOLPHUS COLLENETTE, 11 Commercial Arcade, Guernsey;
SAMUEL FORREST, The Chase, Kenilworth;
JOHN GEORGE GAMBLE, M.A., M.Inst.C.E., Cape Town;
HENRY JOHN MARTEN, M.Inst.C.E., Parkfield House, Wolverhampton;
JOHN NIXON, B.A., Ghyll Bank College, Whitehaven;
WILLIAM PEREGRINE PROPERT, M.A., LL.D., M.B., The Cross House, St. David's, R.S.O.;
SIMPSON ROSTRON, Beddington;
WILLIAM PERKES SWAINSON, Aspen House, Belvedere Road, Upper Norwood, S.E., and
EDWARD WHITE WALLIS, Springfield Road, St. John's Wood, N.W.,
were balloted for and duly elected Fellows of the Society.

The following Papers were read:—

"On Typhoons in China, 1877 and 1878." By Lieut. ALFRED CARPENTER, R.N., F.M.S. (p. 94).

"Note on the Reports of Wind Force and Velocity during the Tay Bridge Storm, December 28th, 1879." By ROBERT H. SCOTT, F.R.S., F.M.S. (p. 98.)

"On the Frost of December 1879, over the British Isles." By WILLIAM MARRIOTT, F.M.S. (p. 102.)

The Meeting was then adjourned.

RECENT PUBLICATIONS.

AMERICAN JOURNAL OF SCIENCE AND ART. Vol. XIX. February, 1880. 8vo.

Contains:—Contributions to Meteorology: being Results derived from an examination of the Observations of the United States Signal Service, and from other sources. By Prof. Elias Loomis. Twelfth Paper, with 3 Plates. The subjects treated of are:—Mean pressure of the Atmosphere over the United States at different seasons of the year; Comparison of barometric minima in Europe and America; and barometric minima advancing with unusual velocity.

ANNALEN DES PHYSIKALISCHEN CENTRAL-OBSERVATORIUMS. Herausgegeben von H. Wild. Jahrgang, 1878. 4to. 1879.

Part I. contains the meteorological and magnetic observations made at the 1st order stations, and Part II. the meteorological observations at 107 stations of the 2nd and 3rd orders in Russia.

CIEL ET TERRE. REVUE POPULAIRE D'ASTRONOMIE ET DE MÉTÉOROLOGIE. Nos. 1-4. March and April, 1880. 8vo. Brussels.

This popular periodical is edited by 8 of the assistants at the Royal Observatory, Brussels, and is published on the 1st and 15th of each month. The chief meteorological articles are:—Les grands froids de décembre 1879, par A. Lan-

caster.—Histoire du thermomètre, par C. Hooreman.—Sur la vitesse du vent, par C. Lagrange.—Les coups de grisou, par A. Lancaster.—La girouette, par F. Van Rysselberghe. In each No. there is also a summary of the weather for the previous fortnight by J. Vincent, and also a list of recent publications by A. Lancaster.

Etude sur les Tempêtes de l'Atlantique Septentrional et Projet d'un Service Télégraphique International relatif à cet Océan. Par N. Hoffmeyer. 4to. 1880. 5 pp. and 4 plates.

Capt. Hoffmeyer discusses the movement of storms across the North Atlantic, and divides them into 4 classes, viz. A. Arctic minima; B. Minima from North America; C. Intertropical minima; D. Partial minima. The author then advocates the establishment of meteorological stations in the Faroe Islands, Iceland, S. Greenland, and the Azores, which should be in telegraphic communication with Europe, and at the same time, Bermuda with North America. The Preface is by Dr. Buys Ballot.

Indian Meteorological Memoirs: being occasional discussions and compilations of Meteorological data relating to India and the neighbouring Countries. Published under the direction of Henry F. Blanford, Meteorological Reporter to the Government of India. Vol. I. Part III. 4to. 1879.

Contains:—Variations of rainfall in Northern India, by S. A. Hill.—Meteorological and hypsometrical observations in Western Tibet, recorded by Dr. J. Scully; with a discussion by H. F. Blanford.

Journal and Proceedings of the Royal Society of New South Wales. 1878. Vol. XII. 8vo.

Contains an article by M. Smith, on the Meteorology of the Coast of New South Wales during the winter months, with the desirability of issuing cautionary storm warnings, by telegrams to the various ports, from the Observatory.—Also, Storms on the Coast of New South Wales, by H. C. Russell.

Notes of Observations of Injurious Insects. Report, 1879. By Miss E. A. Ormerod. 8vo. pp. 44.

Although the temperature was below, and the rainfall above, the average, with little sunshine, insect attack was fully up to the usual amount, and insect presence often exceeded it. The unusual cold of the winter and the depth to which the frost penetrated the ground do not appear to have acted prejudicially on larvæ subjected to them, either at the time or in subsequent development.

Pacific Coast Pilot. Coasts and Islands of Alaska. Second Series. Appendix I. Meteorology, by W. H. Dall, Acting Assistant, United States Coast Survey. 1879. 8vo.

This is a summary of all the accessible meteorological material relating to Alaska and the adjacent regions. It contains an admirable list (extending over 208 pages) of maps, charts, and publications.

Proceedings of the Royal Society. Vol. XXX. No. 200. 8vo.

Contains:—Results of an inquiry into the periodicity of rainfall, by G. M. Whipple. Ten sets of observations are discussed, the longest series being that for Paris, 1689-1875. The author believes that it may now be stated with certainty that all predictions as to rainy or dry years, based upon existing materials, must in future be considered as utterly valueless.

Proceedings of the Royal Society of Edinburgh. Session 1878-79. 8vo.

Contains:—Note on the Distribution of Temperature under the ice in Linlithgow Loch.—On Deep-sea Thermometers, by J. Y. Buchanan.—Why the barometer does not always indicate the real weight of the mass of atmosphere aloft.—Proposed theory of the progressive movement of barometric depressions, by R. Tennent.

REGISTER OF THE RAINFALL KEPT IN GROTE STREET, ADELAIDE, by Sir GEORGE STRICKLAND KINGSTON, from January 1st, 1839, to December 16th, 1879, both inclusive. Foolscap folio. 1879.

This contains Tables, showing the rainfall on each day during the 41 years 1839-79. The rainfall is divided into two well-defined periods of 6 months each; in the dry period—November to April—the average fall is 6·49 ins., and in the wet period—May to October—15·07 ins. A table is also given, showing the monthly and yearly rainfall at Adelaide, Melbourne, and Sydney.

RENDICONTI DEL R. INSTITUTO LOMBARDO. Serie II. Vol. XIV. fasc III. 8vo. 1880.

Contains :—Il Nefodoscopio, instrumento per rilevare la direzione del moto delle nubi, del Prof. Celso Fornioni.

REPORT OF THE ASTRONOMER TO THE MARINE COMMITTEE, MERSEY DOCKS AND HARBOUR BOARD, for the years 1875-78. 8vo. 1879.

This contains :—Results of Meteorological Observations made at the Liverpool Observatory, Bidston, Birkenhead, during the 4 years 1875-78.

REPORT ON THE METEOROLOGICAL SERVICE OF THE DOMINION OF CANADA, BY G. T. KINGSTON, M.A., Superintendent. For the year ending December 31, 1878. 4to. pp. 220.

In addition to much other valuable information, this Report contains tables showing the highest, lowest and mean temperatures for each day of the year 1878 at more than 160 stations in the Dominion of Canada.

SITZUNGSBERICHTE DER KAISERLICHEN AKADEMIE DER WISSENSCHAFTEN. II. Abth. 8vo.

Contains a paper by Dr. J. Hann : Untersuchungen über die Regenverhältnisse von Oesterreich-Ungarn. Part I. : Die jährliche Periode der Niederschläge. Part II. : Veränderlichkeit der Monats und Jahresmengen, gleichzeitige Vertheilung der letzteren in der Periode 1849-78. Nachtrag : Funftägige Mittel des Regenfalles und der Regenwahrscheinlichkeit.

THE COBHAM JOURNALS. ABSTRACTS AND SUMMARIES OF METEOROLOGICAL AND PHENOLOGICAL OBSERVATIONS MADE BY MISS CAROLINE MOLESWORTH, AT COBHAM, SURREY, IN THE YEARS 1825 TO 1850. With Introduction, Tables, &c., by ELEANOR A. ORMEROD, F.M.S. 4to. 178 pp. 1880.

Miss Molesworth kept an elaborate record of meteorological and phenological phenomena, at Cobham. from 1823 to 1867 ; and on her death the MS. Journals were presented to the Meteorological Society. Miss Ormerod has gone carefully through these Journals, and in the present work has given the abstracts and summaries of the observations from 1825 to 1850.

THE JOURNAL OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND. Second Series. Vol. XVI. Part I. No. XXXI. 8vo. 1880.

Contains :—Our Climate and our Wheat Crops, by J. B. Lawes, LL.D., F.R.S., and J. H. Gilbert, Ph.D., F.R.S., (38 pages). The authors first discuss seasons of high and of low productiveness, and then deal with the season of 1878-9, and the experimental wheat crops at Rothamsted.—The past agricultural year, by J. C. Morton.

THE ROSARIAN'S YEAR BOOK FOR 1880. 8vo. 1880.

Contains :—Two papers by E. Mawley, viz.—1. The Rose Weather of 1879, and 2. The Winter of 1878-9.

THE WEATHER OF 1879 AS OBSERVED IN THE NEIGHBOURHOOD OF LONDON, and compared in all respects with that of an average year. By EDWARD MAWLEY, F.M.S. With Tables of Daily Observations and a Diagram. pp. 63. 8vo. 1880.

This is a summary of the weather at Addiscombe, near Croydon, for each month, with Tables of Daily Observations which are compared with the Greenwich average of 38 years. Mr. Mawley remarks that the year 1879 was colder than any of these 38 years, and, with one exception, the most gloomy. Both January and December were extremely cold, while July was extraordinarily dull. It is not, however, the remarkable dulness or coldness of certain months or seasons that calls for special notice, so much as the fact that the whole twelvemonth continued from first to last so persistently sunless and cold.

TRANSACTIONS OF THE WATFORD NATURAL HISTORY SOCIETY AND HERTFORDSHIRE FIELD CLUB. Vol. II. Part 7. 8vo. 1880.

Contains:—Remarks on the Winter of 1878-9, by W. Marriott.—The Temperature of 30 Summers and 30 Winters at Hitchin, by W. Lucas.

ZEITSCHRIFT DER OESTERREICHISCHEN GESELLSCHAFT FUER METEOROLOGIE. Redigirt von Dr. J. HANN. February—April, 1880. 8vo.

Contains:—Ueber die mechanischen Ursachen der Ortsveränderung atmosphärischer Wirbel, von Dr. W. Köppen.—Ueber die Ursache des niedrigen Luftdruckes auf der südlichen Halbkugel, von Dr. P. Andries.—Ueber die Absorption der ultravioletten Strahlen durch Wasser und Eis, von J. L. Schönn.—Beitrag zur Bestimmung der Nordlichtperioden, von Prof. H. Fritz.—Ueber die Temperatur-verhältnisse des December 1879, von Dr. J. Hann.—Temperatur- und Luftdruck-Verhältnisse in der Schweiz während der Kälteperiode im December 1879, von R. Billwiller.—Witterungs-verhältnisse des December 1879 in Baden, von L. Sohncke.—Ueber Bewegungen auf der Erdoberfläche, von M. Thiesen.—Ueber die anomalen Temperaturverhältnisse in Russland im Jahre 1878, von P. Brounow.—Zum Klima des centralen äquatorialen Theiles des grossen Oceans, von Dr. A. Woeikoff.—Meteorologie einer Guano-Insel.—Die Winde des Erdballs. (III.) Der Atlantische Ocean, von Dr. A. Woeikoff.

QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. VI. No. 35.

Comparison of Thermometric Observations made on board the Cunard R.M.S.S. 'Algeria,' by CAPTAIN WILLIAM WATSON, F.M.S, *during 5 passages between Liverpool and New York, in September to December,* 1878. Compiled at the Meteorological Office, and communicated by Captain H. TOYNBEE, F.R.A.S.

[Read March 17th, 1880.]

A PAPER on this subject was printed in the 'Quarterly Journal,' Vol. V., p. 72, and the present discussion is in continuation of that paper, to which reference should be made for a description of the observations and the exposure of the instruments.

All corrections have been applied to the readings. The thermometers have been verified at Kew, and very careful comparisons frequently made by Captain Watson.

Table I. gives the results for the several passages; 224 sets of observations have been used.

Table II. gives the mean results for the various hours, obtained from the last four passages in Table I.; 82 sets of observations have been used for each separate result.

Throughout the discussion the same days have been dealt with in each set of observations, so that the results for the various hours are strictly comparable.

The daily range of temperature is not so regular as might be expected; the observations are too few, and the progress of the ship cuts out for itself a certain range of temperature which interferes considerably with the ordinary diurnal changes. It is, however, evident that for the months under discussion, and in the part of the Atlantic between England and New York, the average

TABLE I.

Date. 1878.	Hour.	Meteorological Office Screen.					Sling Thermometer.					Captain Watson's Screen.										Sea Surface Temp.	Prevailing Wind.	General Weather.
		On top of deck house.					On the most suitable part of the deck.					On the most suitable part of the deck.					110 feet above Sea.							
		Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.			
		°	°	°	In.	o/o	°	°	°	In.	o/o	°	°	°	In.	o/o	°	°	°	In.	o/o	°		
Sept. 24 to Oct. 1 (8 days) Steering W	3 a.m.	58.0	54.1	3.9	.370	77	57.3	53.1	4.2	.351	75	57.4	53.4	4.0	.357	75	56.6	52.2	4.4	.337	73	60.2	NW and SW	Fine, Squally 1 day
	1 p.m.	60.0	56.2	3.8	.401	77	59.2	55.3	3.9	.386	77	59.2	55.5	3.7	.392	78	58.0	54.2	3.8	.372	77	61.8		
	6 p.m.	58.5	55.3	3.2	.394	80	58.3	54.9	3.4	.386	79	58.4	55.1	3.3	.391	80	57.5	54.0	3.5	.372	78	61.3		
	Midnt.	57.2	54.6	2.6	.392	84	57.0	54.4	2.6	.388	83	57.0	54.5	2.5	.391	84	56.5	53.8	2.7	.379	83	57.6		
..	Mean	58.4	55.1	3.3	.391	80	58.0	54.4	3.6	.377	78	58.0	54.6	3.4	.383	79	57.2	53.6	3.6	.365	78	60.2	..	..
Oct. 11 to 18 (8 days) Steering E	4 a.m.	55.1	52.9	2.2	.371	85	55.0	52.7	2.3	.367	85	55.1	52.8	2.3	.369	85	54.2	51.8	2.4	.353	84	58.9	N and NE 2 days SE 3 days SW 3 days	Cloudy, Rain 3 days
	9 a.m.	55.5	53.3	2.2	.378	86	55.4	53.0	2.4	.371	85	55.4	53.1	2.3	.374	86	54.6	52.1	2.5	.356	84	58.4		
	1 p.m.	56.1	53.7	2.4	.382	84	55.7	53.1	2.6	.371	84	55.8	53.4	2.4	.378	84	55.1	52.4	2.7	.358	82	58.0		
	6 p.m.	56.0	54.0	2.0	.391	87	55.8	53.6	2.2	.384	86	55.8	53.7	2.1	.387	86	55.3	53.0	2.3	.372	85	57.9		
	9 p.m.	55.3	53.5	1.8	.386	88	55.2	53.2	2.0	.379	87	55.3	53.4	1.9	.383	87	54.7	52.7	2.0	.372	87	57.3		
	Midnt.	55.1	53.1	2.0	.377	87	55.1	53.0	2.1	.374	86	55.0	53.0	2.0	.375	87	54.6	52.4	2.2	.364	86	57.4		
..	Mean	55.5	53.4	2.1	.381	86	55.4	53.1	2.3	.374	86	55.4	53.2	2.2	.377	86	54.8	52.4	2.4	.362	85	58.0	..	..
Oct. 28 to Nov. 5 (8 days) Steering W	4 a.m.	51.0	48.7	2.3	.316	84	50.9	48.5	2.4	.313	85	50.9	48.5	2.4	.313	85	49.9	47.2	2.7	.292	82	54.3	N and NW 4 days E and SE 4 days	Cloudy, Rain 2 days
	9 a.m.	49.8	47.1	2.7	.290	82	49.6	46.6	3.0	.282	80	49.6	46.8	2.8	.287	82	48.5	45.5	3.0	.270	80	55.3		
	1 p.m.	50.8	47.1	3.7	.280	76	50.1	46.4	3.7	.272	75	50.1	46.5	3.6	.275	76	49.2	45.0	4.2	.253	72	55.3		
	5 p.m.	51.1	47.9	3.2	.296	78	50.7	47.2	3.5	.284	77	50.7	47.4	3.3	.288	78	49.8	46.4	3.4	.276	78	54.6		
	9 p.m.	51.6	48.7	2.9	.309	80	51.2	48.6	2.6	.311	83	51.2	48.2	3.0	.302	80	50.4	47.3	3.1	.289	80	54.6		
	Midnt.	51.3	48.7	2.6	.313	82	51.1	48.7	2.4	.315	83	51.2	48.7	2.5	.314	83	50.4	47.7	2.7	.298	82	53.3		
..	Mean	50.9	48.0	2.9	.300	81	50.6	47.7	2.9	.296	80	50.6	47.7	2.9	.296	80	49.7	46.5	3.2	.279	79	54.7	..	..
Nov. 14 to 22 (9 days) Steering E	4 a.m.	48.8	46.2	2.6	.283	81	48.4	46.0	2.4	.281	83	48.5	45.9	2.6	.279	82	47.3	44.6	2.7	.263	81	55.8	N and NW 4 days W and SW 1 day SE 4 days	Cloudy, Rain 2 days
	9 a.m.	49.7	46.6	3.1	.281	79	49.2	46.0	3.2	.274	78	49.3	46.1	3.2	.275	78	47.9	44.5	3.4	.255	78	56.9		
	1 p.m.	50.6	47.4	3.2	.289	78	49.6	46.2	3.4	.273	77	49.7	46.4	3.3	.277	78	48.6	44.8	3.8	.254	74	56.6		
	5 p.m.	49.5	46.5	3.0	.281	80	48.9	45.7	3.2	.271	79	49.0	46.0	3.0	.276	79	47.8	44.6	3.2	.258	78	56.4		
	9 p.m.	48.9	45.7	3.2	.271	79	48.6	45.3	3.3	.265	77	48.6	45.5	3.1	.269	79	47.6	44.1	3.5	.249	76	55.3		
	Midnt.	49.1	46.1	3.0	.277	79	48.7	45.7	3.0	.272	80	48.8	45.9	2.9	.277	80	47.8	44.6	3.2	.258	78	55.0		
..	Mean	49.4	46.4	3.0	.281	80	48.9	45.8	3.1	.274	80	49.0	46.0	3.0	.276	79	47.8	44.5	3.3	.256	78	56.0	..	..

Date. 1878.	Hour.	On top of deck house.					On the most suitable part of the deck.					On the most suitable part of the deck.					110 feet above Sea.					Sea Surface Temp.	Prevailing Wind.	General Weather.
		Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.			
		°	°	°	In.	o/o	°	°	°	In.	o/o	°	°	°	In.	o/o	°	°	°	In.	o/o	°		
Dec. 2 to 8 (7 days) Steering W	4 a.m.	50·2	48·8	1·4	·327	91	49·8	48·2	1·6	·317	88	49·9	48·3	1·6	·318	89	49·0	47·3	1·7	·305	88	52·0	N and NW 2 days E and SE 4 days S 1 day	Cloudy, Rain 2 days
	9 a.m.	50·0	47·9	2·1	·307	85	49·3	47·1	2·2	·296	85	49·4	47·3	2·1	·300	86	48·4	46·1	2·3	·283	84	53·1		
	1 p.m.	51·1	49·0	2·1	·322	85	50·6	48·6	2·0	·318	86	50·7	48·7	2·0	·320	87	49·9	47·6	2·3	·301	85	52·4		
	5 p.m.	49·5	47·7	1 8	·309	88	48·7	46·9	1·8	·301	87	48·8	47·1	1·7	·303	88	48·0	46·2	1·8	·290	87	52·1		
	9 p.m.	48·8	47·1	1·7	·303	88	48·1	46·5	1·6	·296	89	48·2	46·7	1·5	·300	90	47·7	46·0	1·7	·291	88	51·1		
	Midnt.	49·1	47·4	1·7	·307	88	48·6	46·6	2·0	·294	86	48·6	46·9	1·7	·302	88	47·9	46·2	1·7	·291	88	51·0		
..	Mean	49·8	48·0	1·8	·312	87	49·2	47·3	1·9	·303	87	49·3	47·5	1·8	·306	88	48·5	46·6	1·9	·294	86	52·0	..	..

TABLE II.

Hour.	Meteorological Office Screen. On the top of deck house.					Sling Thermometer. On the most suitable part of the deck.					Captain Watson's Screen. On the most suitable part of the deck.					Captain Watson's Screen. 110 feet above the Sea.					Sea Surface Temp.
	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	Dry.	Wet.	Diff.	Vapour Tension.	Relative Humidity.	
	°	°	°	In.	o/o	°	°	°	In.	o/o	°	°	°	In.	o/o	°	°	°	In.	o/o	°
4 a.m.	51·2	49·1	2·1	·323	86	51·0	48·8	2·2	·318	85	51·0	48·8	2·2	·318	85	50·1	47·6	2·5	·299	83	55·4
9 a.m.	51·2	48·8	2·4	·316	84	50·9	48·2	2·7	·305	82	50·9	48·3	2·6	·308	83	49·8	47·0	2·8	·288	81	56·0
1 p.m.	52·2	49·4	2·8	·318	81	51·5	48·5	3·0	·305	80	51·6	48·7	2·9	·309	80	50·7	47·3	3·4	·286	78	55·7
6 p.m.	51·5	49·1	2·4	·319	84	51·0	48·4	2·6	·309	82	51·1	48·5	2·6	·310	82	50·3	47·5	2·8	·295	81	55·4
9 p.m.	51·1	48·8	2·3	·317	84	50·8	48·4	2·4	·311	84	50·8	48·4	2·4	·311	84	50·1	47·5	2·6	·297	82	54·7
Midnight	51·1	48·9	2·2	·320	84	50·9	48·5	2·4	·313	85	50·9	48·6	2·3	·315	85	50·2	47·7	2·5	·300	83	54·4
Mean	51·4	49·0	2·4	·318	84	51·0	48·5	2·5	·311	83	51·1	48·6	2·5	·312	83	50·2	47·4	2·8	·293	81	55·3
Mean Daily Range ..	1·1	0·6	0·7	·007	5	0·7	0·6	0·8	·013	5	0·8	0·5	0·7	·010	5	0·9	0·7	0·9	·014	5	..

diurnal range of air temperature is less than 2°; the average range by all dry bulb thermometers on deck is 0°·9, as shown in Table II., which also shows the same range at 110 feet above sea level.

The difference between the dry and wet bulb readings on deck is very similar for the various methods of observation, but the average difference at 110 feet is slightly in excess of that on deck.

Out of two hundred and twenty-four observations dealt with in Table I., there are only twenty instances in which the difference between the readings of the dry and wet bulbs at 110 feet above sea exceeds 5°: the maximum difference is 7°·2, reached on two occasions. In all these twenty instances, the difference of dry and wet bulb readings on deck was in defect of that at 110 feet above sea, in six cases to the extent of more than 1°; the average of the twenty cases, using Captain Watson's screen, is 5°·2 on deck, against 6°·0 at 110 feet. In seventeen cases out of the twenty the wind blew from some N point. The results by the sling thermometer fully confirm the above, giving 5°·8 as the average difference for the twenty instances.

When comparing the individual observations, it is very noticeable how close an agreement exists between the differences of dry and wet by the sling thermometer and by the other deck thermometers; the difference by the sling thermometer being generally about 0°·1 in excess of the others.

The diurnal range of vapour tension is very small, and not altogether in accordance with the usually received theory.

The relative humidity ranges lowest in the hottest parts of the day.

As in the former paper, the Meteorological Office screen bears evidence of being, to a slight extent, unduly influenced by radiated heat: in comparing the individual observations, the readings from this screen are often found to be in excess of the readings recorded in Captain Watson's screen, and of those by the sling thermometer, to the extent of 1°, but there are no cases of any important excess.

The results by the sling thermometer bear very favourable testimony to the value of that instrument.

The temperature of the sea ranges about 4° higher than the temperature of the air; the diurnal range is considerably affected by the changes due to the change of locality of the ship.

Of the 224 observations used in Table I., there are only fifteen cases in which the air temperatures read lower on deck than at 110 feet above sea level; in two cases this difference amounted to 1°, and in five others it exceeded 0°·5. Rain was generally falling when the thermometer read lower on deck.

The greatest excess of the deck thermometer over that at 110 feet was 2°·9; the difference amounted to 2° in twenty-one cases out of 224 observations; in all of the twenty-one cases the wind was blowing from some N point, and the sea was much warmer than the air on deck, in one case to the extent of 28°, the average being 14°, whilst in only three cases was it less than 10°. It will be seen that the average result of all the observations shows the sea surface temperature to be only 4° in excess of the air on deck—so that here the influence of the water upon the temperature of the air in contact with it

is clearly shown. Captain Watson, when forwarding the data to the Meteorological Office, called attention to the fact that, whenever he had a N wind with warm water, the mast-head temperature was much lower than that on deck.

The thermometers on deck are about 25 feet above sea level, so that when compared with those at 110 feet there is only a vertical difference in height of 85 feet, and for this change of elevation the accompanying results show an average diminution of temperature of $0^{\circ}\cdot9$; this amount is $0^{\circ}\cdot6$ less than that given in the former paper; but the observations are more numerous in the present paper, and it must be borne in mind that the results are for different months.

The vapour tension and relative humidity range lowest at the higher station.

A turn-over thermometer, by Messrs. Negretti and Zambra, was used during a part of the period, but only for the *day* observations. The reading is given for deck and 110 feet above sea. The results by this instrument agree in a remarkable manner with those taken from Captain Watson's screen. Fifty-six comparisons have been made, and both methods give $1^{\circ}\cdot15$ as the average decrease between the deck and 110 feet above the sea. In the comparison of the individual differences there are only two cases in which the two methods differ to the extent of $0^{\circ}\cdot5$, sixty per cent. of the comparisons agree within $0^{\circ}\cdot1$. This agreement speaks well for the use of the turn-over thermometer as a means of obtaining observations at an elevation.

The original observations are in the Meteorological Office, and can be consulted by any Fellow wishing to see them.

DISCUSSION.

Dr. Tripe inquired what was the construction of Capt. Watson's screen.

Mr. Strachan had not a precise recollection of the particulars as to exposure given in the former paper, but he believed that Capt. Watson's screen was simply a box perforated with holes. He considered that the results were very satisfactory, especially those given by Negretti and Zambra's turn-over thermometer. He thought that it should be stated how the thermometer was turned over.

Mr. Casella said that finding that some little uncertainty prevailed as to the difference between the indications of the thermometers on deck and those up on the mast, and seeing that the indications of the sling thermometer (thermomètre fronde) were referred to, he wished to know whether the indications of this thermometer were accepted as decisive of the precision or otherwise of the thermometers on deck and those on the mast.

Mr. Whipple thought that the height of the thermometer above sea level would vary a great deal, as the action of the wind and sea would cause the ship to roll. Observations of thermometers exposed in different screens were commenced in August last at Kew, and the results in all the stands, as yet, agreed fairly closely.

Mr. Jinman did not believe the level of the ship would be maintained for 3 hours throughout the whole of the voyage. He thought that observations on board a steamer were not very reliable, as it would be exceedingly difficult to get a good exposure.

The President (Mr. Symons) did not think that very much weight could yet be attached to the thermometer screen experiments at Kew, as the observations had hitherto been made chiefly during cloudy weather, when there was little or no

radiation from the ground. The same remark would also apply to Capt. Watson's observations; for the two screens employed by him were very similar, the difference being chiefly that the sides of one were louvred, and of the other perforated with holes. He believed that the sling thermometer gave very accurate results.

Capt. TOYNBEE, through the Secretary, remarked that this Paper, which confirmed a previous one on the same subject compiled from Capt. Watson's observations, was valuable in several ways. 1st. As a test of the ordinary Meteorological Office screen when placed in a *fixed* position, as compared with the *most favourable* position on deck, at the time of observation. 2nd. As showing that the sling thermometer is a valuable instrument for wet-bulb observations, as well as for dry. 3rd. As showing the difference in humidity and temperature between the deck and mast-head; also, that this difference of temperature increases in N. winds. 4th. As a test of the turn-over thermometer when used for mast-head observations. Capt. Watson was preparing a Paper on the use of various anemometers at sea, and he (Capt. Toynbee) thought that much praise was due to him for the very able and careful way in which he worked out the various experiments.

On the Greenwich Sunshine Records, 1876-1880. By WILLIAM ELLIS, F.R.A.S., of the Royal Observatory, Greenwich. (Plate VII.)

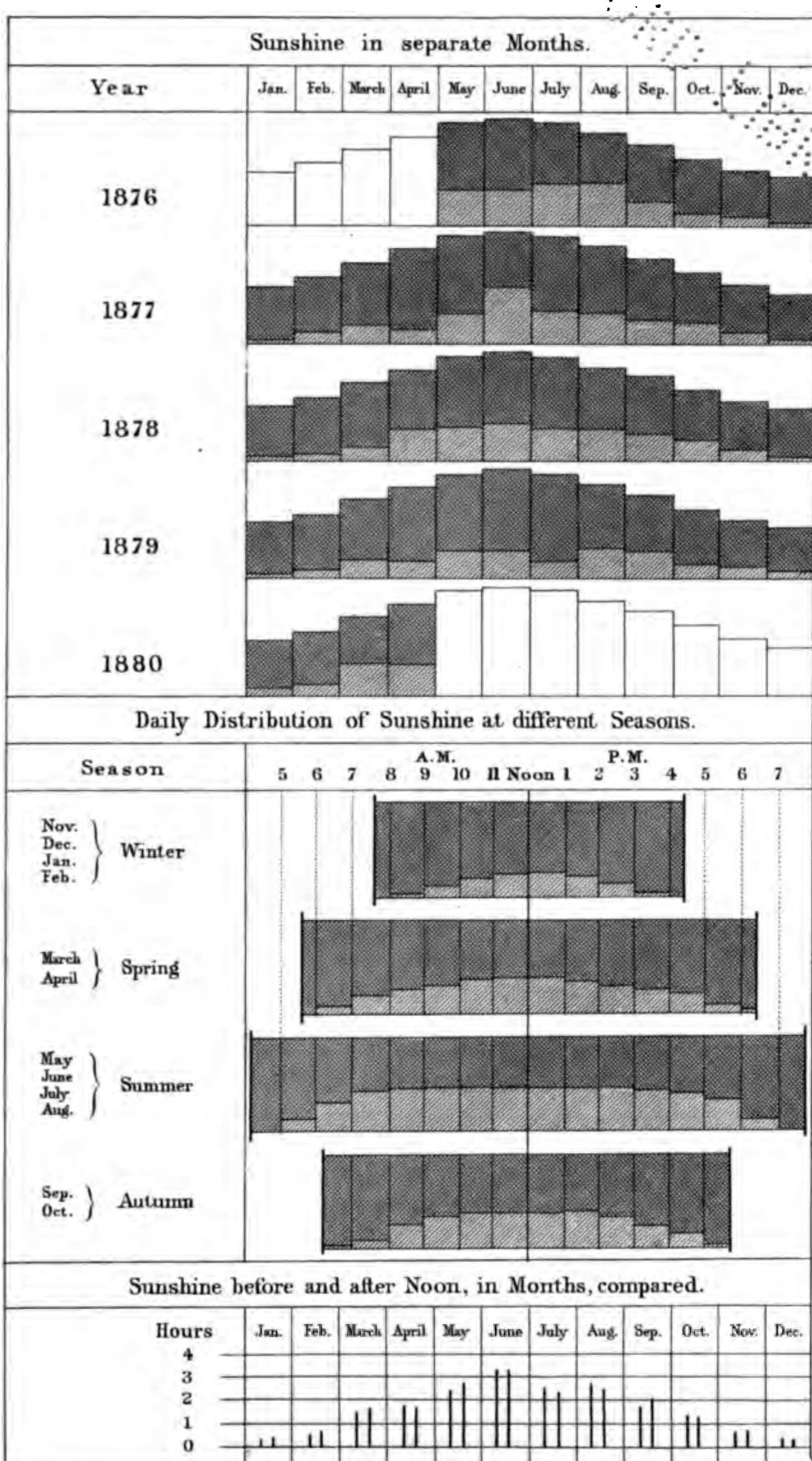
[Read March 17th, 1880.]

THE object of the present paper is to draw the attention of the Fellows of the Society to some results derived from an examination of the sunshine records obtained at the Royal Observatory, Greenwich, by use of Campbell's sunshine instrument; the Astronomer Royal having kindly given me permission to make use of the records for this purpose.

In a former paper (Quarterly Journal, Vol. III., page 460), I gave some brief historical particulars concerning the instrument, together with a description of its form as finally arranged by Mr. Campbell. It is only necessary here to explain, for the benefit of those to whom the instrument may be new, that it consists of a very accurately formed sphere of glass, about four inches in diameter, supported concentrically within a well-turned hemispherical metal bowl, in such a manner, that the image of the sun, formed when the sun shines, falls always on the concave surface of the bowl. The focus of the glass sphere is distant about one inch from the surface of the sphere. A strip of some material (blackened millboard has been nearly throughout used at Greenwich) being fixed in the bowl, the sun, when shining, burns it away at the points at which the image successively falls, and so a record of periods of sunshine is obtained. After sunset the strip is, if necessary, replaced by another, ready for the following day. No record can be obtained when the sun is very near to the horizon, and, in any case, record is obtained only when the sun shines brightly, free from cloud or fog, and the register is to be understood as that of *bright sunshine.* The measure is of *duration* of sunshine only.

The records now discussed are daily records, extending over four years.

SUNSHINE AT THE ROYAL OBSERVATORY, GREENWICH. 1876-1880.



Malby & Sons, Lith.

They commence in May 1876, and terminate with April 1880.* Although this interval is too short for the establishment of trustworthy averages, it has been thought desirable, considering the interest which is known to exist on the subject, to indicate, if even only approximately, some general results.

The Greenwich record is, day by day, transferred to a sheet of paper so prepared that either daily sums, or hourly sums between particular hours through a month, may be taken.

Table I. gives the aggregate amount of sunshine registered in each hour of the day, in each separate month, for the period above-mentioned, and also the total amount and proportion of sunshine (constant sunshine = 1) in each month. The hours are reckoned from *apparent noon*, or from the instant at which the sun is actually on the meridian.

From the numbers given in the columns "Total in Month," and "Hours of Sun above Horizon," has been constructed the upper diagram of Plate VII., "Sunshine in separate Months." In this diagram the unequal distribution of sunshine through the year in different years, as well as the variation of amount in the same month in different years, is well seen. The height of the whole shaded portion in each month represents the comparative number of hours of sun above horizon; the lightly shaded portion indicating the corresponding number of hours of bright sunshine.† Or the whole shaded portion may be taken as representing in each month the comparative length of the day, and the lightly shaded portion the corresponding daily proportion of sunshine. It will be seen how small is the proportion in winter, and how comparatively large in summer. In 1876 the summer sunshine was evenly distributed, and large in amount: in 1877, the month of June was remarkable for large amount of sunshine: in 1878, the summer distribution was even, but less in amount than in 1876, whilst in 1879 the amount was small, the month of July being unusually deficient.

We will now consider the yearly totals. The accompanying numbers (p. 129) are collected from Table I. for more convenient reference, and show the total amount of sunshine in each month.

The numbers expressing the proportion of sunshine show the great deficiency of sunshine in 1879, as compared with the two preceding years.

It will be seen that we have records for forty-eight months, or for four complete years. The sunshine registered during these forty-eight months (May 1876 to April 1880) amounts to 4884·0 hours, giving a yearly average of 1221·0 hours. Dividing this by the average number of hours of sun above horizon (4454·0 in ordinary years, and 4464·8 in leap year) or 4456·7, we get for the average proportion of sunshine, from the four years' observations, 0·274.

* The results for the months of March and April 1880 have been incorporated since the paper was read before the Society.

† Some very trifling inaccuracies exist in the upper diagram of Plate VII., "Sunshine in separate Months," of no importance, however, as regards the general graphical representation.

TABLE I.—Amount of Sunshine registered in each hour of the day in each month, May 1876 to April 188

Year.		No. of Days.	Duration of Sunshine in the hour ending																Total in Month.	Hours of Sun above horizon.
			5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.		
			h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.
January.	1877	31	..	..	..	..	..	0·7	2·9	4·8	4·7	4·3	1·3	..	..	..	..	..	18·7	259·1
	1878	31	..	..	..	..	0·5	3·0	6·2	7·2	6·9	5·7	4·7	0·8	..	..	..	..	35·0	259·1
	1879	31	..	..	..	..	..	3·1	3·4	3·0	3·0	0·9	0·8	0·6	..	..	..	..	14·8	259·1
	1880	31	..	..	..	..	0·8	3·4	5·2	7·6	6·8	9·2	7·3	2·0	..	..	..	..	42·3	259·1
Feb.	1877	28	..	..	..	0·2	1·8	3·9	4·3	4·6	7·5	8·0	5·2	0·9	..	..	..	..	36·4	277·9
	1878	28	..	..	..	..	0·5	2·2	4·8	5·3	6·3	7·1	5·2	1·3	0·2	..	..	..	32·9	277·9
	1879	28	..	..	..	0·2	2·5	4·8	6·2	4·8	4·2	3·9	3·7	1·2	0·2	..	..	..	31·7	277·9
	1880	29	..	..	..	0·3	2·9	5·6	6·8	8·7	8·1	8·7	8·1	3·2	0·2	..	..	..	52·6	288·7
March.	1877	31	..	..	1·2	6·0	11·6	12·6	14·0	11·7	12·3	10·6	8·7	6·0	4·4	0·2	..	..	99·3	366·9
	1878	31	..	..	0·7	2·4	5·0	6·8	9·2	10·3	11·9	9·5	8·6	6·4	2·2	0·1	..	..	73·1	366·9
	1879	31	..	..	..	3·8	7·5	10·0	12·5	12·1	12·4	10·9	9·3	8·4	3·6	0·5	..	..	91·0	366·9
	1880	31	..	..	0·5	5·2	8·4	11·9	13·6	15·0	16·4	17·5	18·5	15·9	13·6	4·5	..	..	141·0	366·9
April.	1877	30	..	..	3·8	5·8	7·0	9·4	8·7	8·2	6·8	8·7	5·6	3·4	2·9	1·5	..	..	71·8	414·9
	1878	30	..	0·4	5·8	9·8	12·4	11·0	14·1	16·6	14·8	14·1	14·1	11·6	12·4	9·9	3·4	..	150·4	414·9
	1879	30	..	..	1·3	4·8	6·8	6·7	9·3	8·2	9·2	8·3	7·1	5·4	4·7	2·7	0·1	..	74·6	414·9
	1880	30	..	0·6	6·6	10·4	11·7	11·0	11·7	14·0	12·5	11·8	11·7	11·5	11·7	7·1	0·2	..	132·5	414·9
May.	1876	31	..	4·8	9·9	11·4	9·4	11·0	13·3	15·1	16·9	16·2	17·0	18·2	18·8	16·4	10·3	..	188·7	482·1
	1877	31	0·1	6·0	11·2	12·5	11·3	13·4	13·2	12·1	11·1	12·2	11·9	10·9	10·1	7·7	3·4	..	147·1	482·1
	1878	31	..	1·8	8·1	10·5	12·1	12·2	15·1	15·4	15·9	14·6	17·5	13·3	13·7	11·0	4·8	..	166·0	482·1
	1879	31	..	2·5	8·9	10·4	10·3	12·4	12·6	11·5	10·2	9·8	9·0	12·1	11·4	9·9	4·6	..	135·6	482·1
June.	1876	30	0·2	7·1	12·1	13·8	13·9	14·6	15·2	14·6	14·2	16·0	13·9	14·6	12·9	12·1	9·1	0·2	184·5	494·5
	1877	30	..	10·2	17·2	20·5	21·9	22·6	21·4	21·0	22·3	20·4	20·8	20·9	18·7	18·5	10·7	..	267·1	494·5
	1878	30	..	5·2	12·7	15·1	14·2	15·2	16·8	15·2	16·7	13·9	13·0	14·2	14·2	11·8	5·1	0·1	183·4	494·5
	1879	30	..	5·2	8·7	9·6	12·0	9·3	9·2	13·2	14·0	12·3	12·3	10·6	10·0	10·7	4·4	0·4	141·9	494·5
July.	1876	31	..	5·4	11·4	15·0	16·5	18·8	20·0	20·8	18·4	18·5	17·6	17·4	19·2	15·6	6·7	0·2	221·5	496·8
	1877	31	..	6·8	15·3	15·9	15·2	15·4	15·0	15·0	13·8	14·4	14·0	12·1	9·9	9·8	4·6	..	177·2	496·8
	1878	31	..	1·5	11·9	15·3	15·5	15·7	13·8	12·1	11·4	13·0	13·9	14·1	12·4	10·3	3·0	..	163·9	496·8
	1879	31	..	2·0	6·4	9·1	7·7	6·2	6·5	7·0	6·1	8·8	9·2	9·1	11·2	8·0	2·0	..	99·3	496·8
August.	1876	31	..	3·4	10·7	17·4	19·9	21·4	22·0	17·4	16·7	18·0	19·2	17·2	15·9	14·1	3·6	..	216·9	449·1
	1877	31	..	0·7	8·6	11·8	14·5	17·3	15·3	17·3	14·8	14·3	14·5	10·0	11·4	7·4	0·7	..	158·6	449·1
	1878	31	..	0·2	7·1	10·4	13·6	14·0	16·1	16·7	14·5	15·1	16·3	13·2	11·2	9·7	1·9	..	160·0	449·1
	1879	31	..	0·8	8·1	11·2	14·0	13·2	14·2	12·0	11·0	10·9	13·7	11·5	10·1	8·0	0·4	..	139·1	449·1
Sept.	1876	30	..	..	1·3	2·7	6·9	10·9	13·5	11·7	11·1	13·7	14·2	9·5	6·7	3·9	..	..	106·1	376·9
	1877	30	..	..	1·9	5·3	8·7	12·6	12·3	11·8	12·5	13·8	9·7	9·2	6·6	1·2	..	..	105·6	376·9
	1878	30	..	..	2·7	7·9	12·2	13·3	12·4	14·1	14·8	13·6	12·3	10·8	10·6	2·8	..	..	127·5	376·9
	1879	30	..	..	1·7	5·9	9·7	10·8	11·4	12·3	13·8	14·0	11·8	11·6	9·8	3·7	..	..	116·5	376·9
October.	1876	31	..	..	..	1·7	4·8	6·3	8·0	7·4	7·4	8·6	7·7	3·8	0·7	..	..	..	56·4	328·7
	1877	31	..	..	..	1·1	8·7	13·9	16·8	15·2	14·5	11·9	11·4	5·9	1·7	..	..	..	101·1	328·7
	1878	31	..	..	..	1·7	9·2	12·4	13·5	14·8	14·3	13·0	11·8	7·4	2·7	..	..	..	100·8	328·7
	1879	31	..	..	..	0·8	3·7	7·5	9·2	10·5	9·2	9·9	10·2	4·8	0·9	..	..	..	66·7	328·7
Nov.	1876	30	..	..	..	..	0·2	0·6	4·0	8·2	10·4	8·4	4·1	..	..	..	..	..	35·9	264·4
	1877	30	..	..	..	..	1·1	9·4	10·3	9·5	9·2	8·9	7·0	1·2	..	..	..	..	56·6	264·4
	1878	30	..	..	..	..	2·0	4·5	6·3	8·7	7·6	5·2	4·7	1·5	..	..	..	..	40·5	264·4
	1879	30	..	..	..	..	0·1	1·5	6·2	7·5	9·8	8·8	8·3	1·0	..	..	..	..	43·2	264·4
Dec.	1876	31	..	..	..	..	..	..	0·8	2·3	1·8	1·6	..	..	..	..	..	..	6·5	242·7
	1877	31	..	..	..	..	..	1·1	6·0	6·0	7·3	5·7	0·9	..	..	..	..	..	27·0	242·7
	1878	31	..	..	..	..	0·1	1·3	3·6	4·7	4·4	1·8	0·4	..	..	..	..	..	16·3	242·7
	1879	31	..	..	..	..	0·1	1·2	3·7	6·4	6·9	7·1	2·8	0·2	..	..	..	..	28·4	242·7

In the month of May 1876 the instrument was in use only on 25 days: the observed durations given above Table have, in consequence, been increased in the proportion of 25 to 31, to render them compa with the durations for the same month in other years. In the months of July and October of the same the instrument was in use only on 30 and 26 days respectively: the durations for July have been increa the proportion of 30 to 31, and those for October in the proportion of 26 to 31. These alterations, of c do not affect the "Proportion of Sunshine" (last column of the Table).

Month.	Sun above horizon in hours.	Total Amount of Sunshine.				
		1876.	1877.	1878.	1879.	1880.
	h.	h.	h.	h.	h.	h.
January	259·1	..	18·7	35·0	14·8	42·3
February	277·9 / 288·7 in leap year	..	36·4	32·9	31·7	52·6
March	366·9	..	99·3	73·1	91·0	141·0
April	414·9	..	71·8	150·4	74·6	132·5
May	482·1	188·7	147·1	166·0	135·6	..
June	494·5	184·5	267·1	183·4	141·9	..
July	496·8	221·5	177·2	163·9	99·3	..
August	449·1	216·9	158·6	160·0	139·1	..
September........	376·9	106·1	105·6	127·5	116·5	..
October	328·7	56·4	101·1	100·8	66·7	..
November	264·4	35·9	56·6	40·5	43·2	..
December	242·7	6·5	27·0	16·3	28·4	..
Sum	..	1016·5 (8 months)	1266·5	1249·8	982·8	368·4 (4 months)
Proportion of Sunshine = Sum divided by corresponding hours of Sun above horizon		..	0·284	0·281	0·221	..

An estimate of the probable general average proportion of sunshine at Greenwich may be made in the following way:—

Taking the Greenwich observations of the amount of cloud for the twenty-five years 1855 to 1879, the mean annual value (deduced from observations made daily at 9 a.m., noon, 3 p.m., and 9 p.m.) is found to be 6·82 (0 representing a clear sky and 10 an overcast sky). The mean value for the forty-eight months for which we have sunshine records is 7·01 or the period was more cloudy than the average, that is, there was less sunshine. Or the general average proportion of bright sunshine at Greenwich will be greater than the average for the forty-eight months, or greater than 0·274, but, probably, not greater than about 0·29 or 0·30.

Our attention will now be turned to the distribution of sunshine through the day. Taking for each month the means of the numbers standing in the vertical columns of Table I., and dividing by the number of days in the month (28¼ in February), we find for each month the mean amount of sunshine during each hour of the day. Such results are given in Table II., the monthly results being further combined to show the seasonal change, taking November, December, January, and February, to represent the winter effect; March and April, the spring effect; May, June, July, and August, the summer effect; and September and October, the autumn effect.

The numbers in Table II., representing the winter, spring, summer, and autumn effects, have been used to form the middle diagram of Plate VII., "Daily Distribution of Sunshine at different Seasons." In this diagram the horizontal spaces represent hourly intervals, excepting the outermost spaces in each group; that towards the left in each group indicating the interval between sunrise and the first nominal hour afterwards, and that towards the

TABLE II.—Mean Duration of Sunshine in each hour of the day, for Months and Seasons.

Month.	Mean duration of Sunshine in the hour ending															Mean daily amount of Sunshine.	Corresponding hours of Sun above horizon.	Proportion of Sunshine.
	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.			
	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	
November	..	..	..	·03	·13	·22	·28	·31	·26	·20	·03	..	..	..	..	1·5	8·8	0·17
December	..	..	..	..	·03	·11	·16	·16	·13	·03	..	..	..	..	..	0·6	7·8	0·08
January	..	..	..	·01	·08	·14	·18	·17	·16	·11	·03	..	..	..	..	0·9	8·4	0·11
February	..	..	·01	·07	·15	·19	·21	·23	·24	·20	·06	·01	..	..	..	1·4	9·9	0·14
Mean of November, December, January, February = Winter effect	..	..	..	·03	·10	·17	·21	·22	·20	·14	·03	..	..	..	..	1·1	8·7	0·13
March	..	·02	·14	·26	·33	·40	·40	·43	·39	·36	·30	·19	·04	..	..	3·3	11·8	0·28
April	·01	·15	·26	·32	·32	·37	·39	·36	·36	·32	·27	·26	·18	·03	..	3·6	13·8	0·26
Mean of March and April = Spring effect......	..	·08	·20	·29	·32	·38	·39	·39	·37	·34	·28	·23	·11	·02	..	3·4	12·8	0·27
May	·12	·31	·36	·35	·40	·44	·44	·44	·43	·45	·44	·44	·36	·19	..	5·1	15·6	0·33
June	·23	·42	·49	·52	·51	·52	·53	·56	·52	·50	·50	·46	·44	·24	·01	6·5	16·5	0·39
July	·13	·36	·45	·44	·45	·45	·44	·40	·44	·44	·43	·43	·35	·13	..	5·3	16·0	0·33
August	·04	·28	·41	·50	·53	·55	·51	·46	·47	·51	·42	·39	·32	·05	..	5·4	14·5	0·37
Mean of May, June, July, August = Summer effect	·13	·34	·43	·45	·47	·49	·48	·47	·47	·47	·45	·43	·37	·15	..	5·6	15·7	0·36
September	..	·06	·18	·31	·40	·41	·42	·43	·46	·40	·34	·28	·10	..	..	3·8	12·6	0·30
October	..	..	·04	·21	·32	·38	·39	·37	·35	·33	·18	·05	..	..	..	2·6	10·6	0·25
Mean of September and October = Autumn effect	..	·03	·11	·26	·36	·40	·40	·40	·41	·36	·26	·16	·05	..	..	3·2	11·6	0·28

right the interval between the last nominal hour before sunset, and sunset; the sunrise and sunset lines being made to project in order to easily distinguish them from the intermediate hour lines: the amount of light shading, as compared with the amount of dark shading, indicates the proportion of sunshine to shade in each hour of the day.

It will be thus seen that, as deduced from the mean of four years' observations, the distribution of sunshine through the day is very uniform, the portions before and after noon being practically symmetrically placed as regards noon. It is striking to notice, in summer, how early in the day the maximum proportion of sunshine is reached, and how nearly uniform it continues (as shown by the upper boundaries of the lightly shaded spaces) until towards the time of sunset. For ten hours, that is from 7 a.m. to 5 p.m., there is scarcely any change. In each of the other seasons the increase before noon and decrease after noon are much more gradual. The diagram makes it appear that sunshine has been recorded until the time of actual sunset in spring and autumn, and from actual sunrise in autumn, although it has previously been mentioned that register cannot be obtained when the sun is very near to the horizon. This apparent anomaly is due partly to the circumstance that the amount of sunshine is tabulated by hourly intervals (the first interval after sunrise and the last before sunset being necessarily shorter than the others), without regard to the distribution of sunshine during each interval, and partly to the fact that, in the months grouped together, the days are not throughout quite of the same length.

In my former paper it was found from the observations of one year that generally there was more sunshine after noon than before noon (reckoning, of course, from the time of the sun being actually on the meridian). The accumulated four years' observations confirm this, though the effect is not so marked. By summing up the numbers contained in Table II., for the hours before noon, and for the hours after noon, the mean difference in each month is found as follows:—

Month.	Mean Duration of Sunshine. Before noon.	Mean Duration of Sunshine. After noon.	Excess of Duration after noon above Duration before noon.		
	h.	h.	h.		m.
January	0·41	0·47	+0·06	=	+ 3·6
February	0·63	0·74	+0·11		+ 6·6
March	1·55	1·71	+0·16		+ 9·6
April	1·82	1·78	—0·04		— 2·4
May	2·42	2·75	+0·33		+19·8
June............	3·22	3·23	+0·01		+ 0·6
July	2·72	2·62	—0·10		— 6·0
August	2·82	2·62	—0·20		—12·0
September	1·78	2·01	+0·23		+13·8
October	1·34	1·28	—0·06		— 3·6
November	0·66	0·80	+0·14		+ 8·4
December	0·30	0·32	+0·02		+ 1·2

There is more sunshine after noon than before noon in eight months, and

less in the remaining four months. On the average the duration of sunshine is greater after noon than before noon by ·055 hour = 3·3 minutes. A graphical representation of the preceding numbers is given in the lower part of Plate VII. In each pair of lines, that to the left indicates the duration of sunshine before noon, and that to the right the duration after noon. The near equality in the lengths of the two lines in each month is well seen, although there is a decided indication of more sunshine after noon than before noon, a result which the Greenwich observations of cloud also lead us to expect. The small irregularities are probably in part accidental.

All that has preceded refers to the duration of sunshine. I would, however, here allude to some results in regard to the heat of sunshine, obtained by Professors Roscoe and B. Stewart ("Proceedings of the Royal Society," Vol. XXIII., p. 578), from the treatment of wooden bowls exposed, each one for six months, from solstice to solstice. The amount of wood burnt out of these bowls was considered to give a measure of the heat of sunshine during the particular half-year of exposure. A discussion of the results given by bowls so exposed during a period of twenty years showed that, almost without exception, the heat of sunshine was very much greater during the interval between the summer and winter solstice than during that between the winter and summer solstice. The observations of duration now discussed show in a lesser degree a similar inequality. Taking the summer solstice as occurring at noon of June 21, and the winter solstice at midnight of December 20, which divides the year into two periods of 182½ days each, I find in fact as follows:—

Period ending	Total Duration of Sunshine between Solstices. Summer and Winter.	Winter and Summer.
	h.	h.
1876. December	710·5	....
1877. June	....	566·9
„ December	685·0	....
1878. June	....	565·6
„ December	690·9	....
1879. June	....	447·3
„ December	538·8	....
Means	656·3	526·6

There is thus a sensible difference in the amount of sunshine during the two portions of the year, there being on the average 129·7 hours more sunshine during the half-year following the summer solstice than in the half-year preceding. Whether this difference is in part accidental, or whether it be an indication of a real effect, will be more accurately determined when we have accumulated a longer series of observations. The half-year following December 1879 seems so far (April, 1880) likely to yield a large amount of sunshine.

There are very few days without sunshine, to some amount, during the summer portion of the year. Thus, during the year 1877, sunshine was

registered on 279 days, and on 86 days there was no register. of the latter, 30 days only occurred during the months from March to October, and 56 in the months of January, February, November and December. The corresponding numbers in 1878 were 281, 84, 20 and 64, and in 1879 were 259, 106, 39 and 67. In the months of May, June, July and August, of the three years 1877 to 1879, including in all 369 days, there were only 21 days without sunshine.

The greatest daily durations observed in each month from May 1876 to April 1880 were as follows :—

	h.		h.
In January	7·6	In July	13·3
February	7·3	August	12·4
March	10·4	September	11·3
April	12·3	October	8·6
May	13·7	November	5·6
June	13·9	December	5·6

These durations fall short, by periods varying from one to somewhat over two hours, of the interval during which the sun was above the horizon, by no means so much on account of inability to register when the sun is near the horizon, as from the extreme rarity of a day of entirely bright sunshine. No very great amount of vapour is sufficient to stop the very early and very late registration, so that a day on which registration commences at the earliest possible moment after sunrise at which under the best circumstances it can be effected, continues without interruption throughout the day, and terminates at the latest possible time in the evening at which registration can be effected, is altogether exceptional. That it is quite possible to obtain registration nearer to the horizon than would appear from what has preceded, we know, from what happens in particular cases. For in favourable circumstances registration is not unfrequently effected, at one or other end of a day, within 30 minutes of the time of the sun being in the horizon. Such instances have occurred in spring, autumn, and winter, but registration in summer appears to have never been obtained within from 40 to 55 minutes of the time of sunrise or sunset. For convenience, the interval (near to sunrise and sunset), during which registration cannot be effected with this form of apparatus, may be called the instrumental loss. A consideration of the purely astronomical aspect of the question, on the supposition that the sun has at all times power to register on reaching a certain definite altitude, although it would lead us to expect a greater instrumental loss in summer than in spring or autumn, affords no explanation of the small instrumental loss in winter, since the sun, at this period, half an hour after sunrise, attains a still less altitude than in summer. The difference in this respect observed at different seasons of the year is perhaps a small one about which to be very certain, considering the character of the record, but should it be hereafter confirmed, the circumstance seems to admit of explanation meteorologically, only on the supposition that, in winter, the atmosphere, when free

from cloud, is at times in a peculiar degree transparent, more so than in summer.

As regards what I have called the "instrumental loss," it is to be remarked that the sun, near to sunrise or sunset, even when in no way obscured, probably exerts little influence either on animal or vegetable life. So that averages derived from the registers as we now get them may more nearly indicate the duration of actual beneficial sunshine than would more perfect registers. Further, judging from the rapid falling off in amount of sunshine (see Diagram of "Daily Distribution of Sunshine at different Seasons") near to sunrise and sunset, due in great measure to cloud and vapour, it is evident that the actual loss of register, below the point at which the instrument will record, must be extremely small; that is to say, if it were capable of registering down to the horizon, the numbers would probably not be very much increased.

Some points I have not at all touched upon, as for instance, the connection with temperature, and the influence of wind. The former I have to some extent treated in my previous paper; the latter, as regards Greenwich and Kew, has already been discussed for one year, by Mr. Whipple.

At the beginning of the year 1879 a sunshine instrument, similar to that in use at Greenwich, was supplied to the Right Hon. H. Brand, Speaker of the House of Commons, for use at Glynde, near Lewes, he having some idea that there was, on the whole, more sunshine at Glynde than in London. Having been favoured by him with the monthly amounts of sunshine recorded at Glynde since the commencement of registration, I add the following comparison with the corresponding Greenwich results:—

Month.	Amount of Sunshine recorded at Greenwich.	Amount of Sunshine recorded at Glynde.	Excess of Sunshine at Glynde.
	h.	h.	h.
1879. January	14·8	16·1*	+ 1·3
February	31·7	31·3	— 0·4
March	91·0	92·5	+ 1·5
April	74·6	100·3	+25·7
May	135·6	151·3	+15·7
June	141·9	140·9	— 1·0
July	99·3	90·6	— 8·7
August	139·1	139·3	+ 0·2
September	116·5	115·5	— 1·0
October	66·7	84·6	+17·9
November	43·2	45·8	+ 2·6
December	28·4	31·6	+ 3·2
1880. January	42·3	60·4	+18·1
February	52·6	45·9	— 6·7
March	141·0	159·6	+18·6
April	132·5	128·3	— 4·2

* The instrument was put up on January 7: previous to this day 1·9 hours had been registered at Greenwich: this amount has, therefore, been added to the Glynde record, January 7 to 31 (14·2 hours) in order to obtain a comparative number for Glynde for January.

The preceding comparison is interesting. The total amount registered during the year 1879, at Greenwich, was 982·8 hours: at Glynde 1039·8 hours: excess at Glynde 57·0 hours. The very sunless month of July was even more sunless at Glynde than at Greenwich. The Speaker mentions that his instrument is so placed that hills to the westward of the house cause obstruction for about half an hour at sunset, but this, as will be understood from what has been already said in regard to the probable small actual loss of register at Greenwich at low altitudes, is of little moment.

Other instruments besides that to which reference has just been made, and in addition to those that have for some time been in use at Greenwich and Kew, have also, I believe, been set up. The question of obtaining an extended series of records has also for some time engaged the attention of the Meteorological Council, and a more simple form of instrument, in some respects, having been, under the direction of the Council, prepared, registration has this year (1880) been commenced, in connection with the Meteorological Office, at a number of stations throughout the country. In matters concerning agriculture and the public health, the accumulated records which we may thus in a few years hope to possess can hardly fail to lead to conclusions of considerable interest.

DISCUSSION.

Mr. SCOTT inquired what was considered as a record of sunshine at Greenwich; whether complete burning or the mere scorching of the card? On a foggy day the card at some of the Meteorological Office Stations had been occasionally found to be blistered, but not in any way discoloured. He would also like to know whether any one was allowed to wipe off the dew and hoar frost from the ball, as he thought such deposits ought to be allowed to remain on the ball, inasmuch as they could not be removed at sunrise in summer without inconvenience. He stated that the records of sunshine in wooden bowls discussed by Profs. Roscoe and Stewart had been kept for 20 years at the Local Government Office, 1 Richmond Terrace, Whitehall, by Mr. J. C. Haile. In 1873 the instrument and the complete series of bowls was transferred to the Meteorological Office, and the record was now kept up at Kew.

Mr. WHIPPLE said that Dr. Roscoe had shown that there was a greater amount of sunshine in the half-year between the summer solstice and the winter solstice than in the other half from winter to summer. The same thing was also proved by Campbell's records. He thought it very remarkable that the instrument registered so near sunrise as it appeared to do. With regard to mist or haze stopping the record, he noticed the other day, at Kew, that between 4 and 5 p.m. the instrument stopped registering, although the sky appeared to be perfectly clear. He thought that some rule ought to be established with regard to the cleaning of the ball, as in winter it was often covered with hoar frost.

Mr. MAWLEY said that after 15 consecutive months of cold weather, during the greater part of which there had been a marked deficiency of sunshine, he thought it would be interesting to inquire to what extent underground temperatures had been affected. With this object in view he had recently written to the Astronomer Royal, who had most kindly supplied him with particulars which enabled him to state that although at Greenwich the mean temperature of the soil during March, at the depth of 3 feet, was higher than is usual, yet we have to go back 25 years in order to find any instance of the ground in March at the depth of 12 feet being, in any but the slightest degree, colder than it was in the same month of the present year. So that, at the present time, while the soil near the surface was enjoying almost the full benefit of the unusual amount of bright sunshine of the last few months, that at greater depths still continued remarkably cold. One effect, he considered, of this condition of things below ground would be to greatly retard the coming into leaf this spring of deeply rooted trees, whereas shrubs and

shallow rooted trees would probably be in leaf about the same time, and in some cases even rather earlier than usual.

Rev. T. A. PRESTON thought that the ball should not be cleaned if the sun could not melt the hoar-frost.

Mr. ELLIS said that the registering material used at Greenwich (blackened millboard) was burnt through only in summer. Any distinct marking or discoloration was reckoned as sunshine. It was the custom to examine the instrument every day at 9 a.m., and if there was moisture on the glass it was wiped off, but this was seldom necessary. In the last two winters the bowl had been once or twice filled with snow, and hoar frost had on a few occasions interfered with the record; but the winters were both of exceptional severity.

The PRESIDENT (Mr. Symons) was glad to hear that the old system of wooden bowls was still in use at Kew. He thought it very desirable that the balls should be kept clean, as in large manufacturing towns they were likely to get very dirty, and thereby the registration would be vitiated. If cleansing remained prohibited, town records would not only be (properly) diminished by the smoke in the atmosphere, but also (improperly) through the apparatus not being in perfect order.

Mr. SCOTT, in reply to a question put by Mr. B. Woodd Smith, said that in bright sunshine the paper would burn in 2 seconds. It had also been found that paper of a light Prussian Blue colour was the most satisfactory.

The PRESIDENT (Mr. Symons) considered that there should be a regulation that the ball should be cleaned with a silk handkerchief every time that the card was changed.

On the Rate at which Barometric Changes traverse the British Isles. By GEORGE MATHEWS WHIPPLE, B.Sc., F.R.A.S., F.M.S., Superintendent of the Kew Observatory. (Plate VIII.)

[Read April 21st, 1880.]

ONE of the first meteorological facts brought to light by the comparison of curves produced by self-recording meteorological instruments, was the existence of a time-interval in the occurrence of squalls at places not far distant from one another.

Messrs. Glaisher, Balfour Stewart, Ellis, and others have from time to time published accounts of particular instances where this time-interval has been observed, notably in the case of squalls passing over the Oxford, Kew and Greenwich observatories.

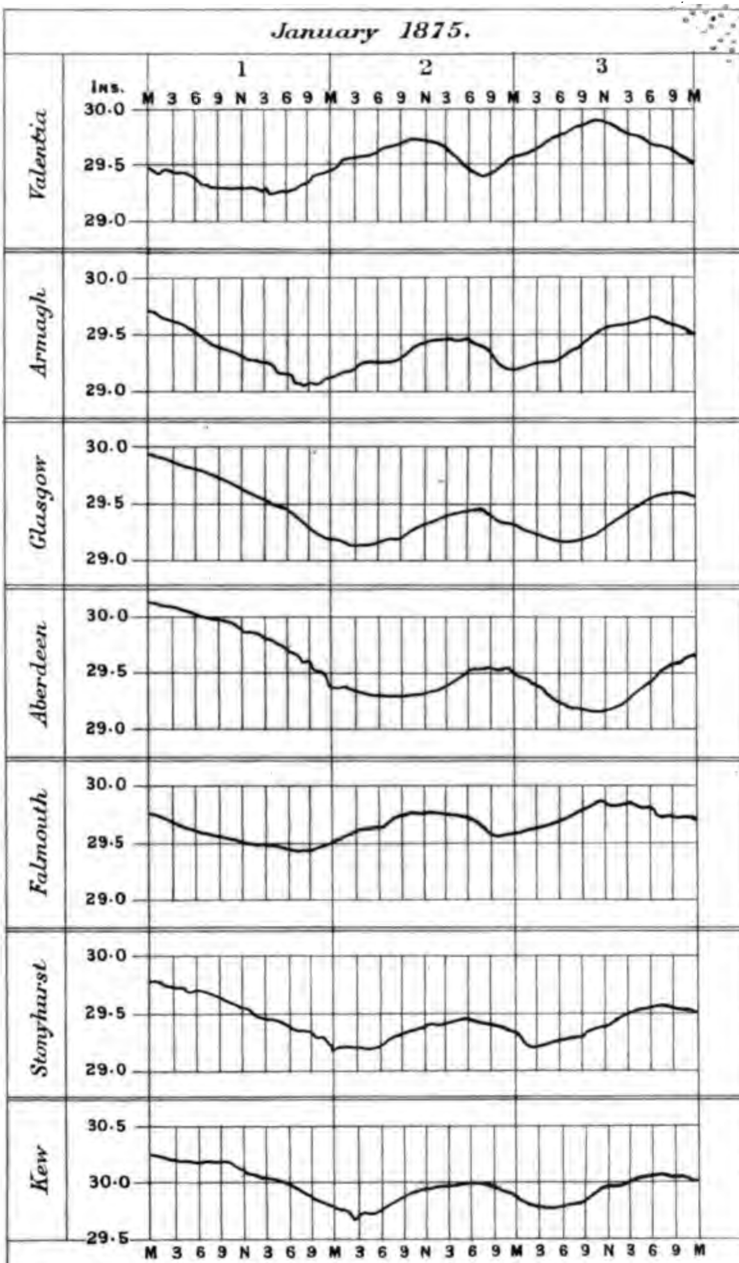
Subsequently, on the publication of the Quarterly Weather Reports of the Meteorological Office, I took up the matter, and in 1873 read a paper before the British Association,* giving the result of a discussion of the passage of 23 squalls across the British Isles in the years 1869-72, and stating that I had concluded that the motion of these squalls was generally from westward to eastward, and that their average velocity was about 38 miles per hour.

The issue of the Daily Weather Charts, however, has shown that the motion of areas of barometric depression is extremely irregular over the surface of this country, and as, of course, the variations in the height of the barometer, at any given place, are to a great degree dependent upon the changes in position of the cyclone or anticyclone covering it, there seemed to be but

* *Vide* Report for 1873, page 44.

TRANSIT OF BAROMETRIC CHANGES.

(From the Quarterly Weather Report No. 30 Part I Plate I.)



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small chance of determining any laws as to the progress of these movements from the scanty information which the curves of the 7 self-recording observatories afford.

On going through the volumes of the 'Quarterly Weather Reports,' of which at present there exist seven in a completed state, viz. those for 1869-75, it recently occurred to me that it would be interesting to find what evidence they offered in proof of the theory strongly held by many persons that weather changes, as a rule, travel from West to East. Having, with this view, examined a number of the records of the passage of storms across the British Isles, I was led to the conclusion that the general direction was more nearly from SW to NE than from W to E.

Fortunately the distribution of the 7 observatories is such as to assist the investigation greatly, for 4, viz. Valentia, Armagh, Glasgow and Aberdeen, lie along a line almost directly SW-NE, whilst if, of the remaining 3, we take a point midway between Stonyhurst and Kew, say Leicester, and join that

point with Falmouth, we obtain another course parallel to the first and also running SW-NE. The distances between the various observatories measured along these tracks are :—

For the Northern track :—

Valentia to Armagh	=	227	miles.
Armagh to Glasgow	=	140	,,
Glasgow to Aberdeen	=	122	,,

For the Southern track :—

Falmouth to Leicester	=	258	,,

Having examined the engraved barometer curves, and selected carefully the points of maximum and minimum, I divided them into two classes :—(1.)

Those which traverse the United Kingdom in the SW-NE direction, or normals; and (2.) Those moving in directions not SW-NE, or abnormals.

The relative number of these two classes occurring each year is shown in Table I., the maxima and minima being counted separately.

TABLE I.

Barometric changes moving	1869.	1870.	1871.	1872.	1873.	1874.	1875.	Total.
Normally	40	47	43	63	47	43	59	342
Abnormally	20	9	17	24	11	25	21	127
Totals	60	56	60	87	58	68	80	469

The normal movements were then alone farther considered, the abnormals being left for future discussion.

The first step was to determine the times at which any particular maximum or minimum passed over the observatories in succession. Owing to the extremely minute scale of the engravings, it was only possible to do this for barometric changes taking place with tolerable rapidity; as, in the case of a sluggish barometric movement, the exact instant of maximum or minimum reading could not be fixed with any degree of precision. It was also found that with the contracted time scale in which 1 hour covers a space of only 0·04 in. in length, the possible error of estimated time of transit is about half-an-hour.

As an illustration of the method employed, we take the case of the first two maxima and minima in 1875, which are represented on Plate VIII. The measurements of the passage of these are given in Table II., the rates being expressed in miles per hour.

TABLE II.

1875.	Valentia.		Armagh.			Glasgow.			Aberdeen.			Fal-mouth	Stony-hurst.	Kew.	Leicester. compd.	F. — L.	
No.	Date.	Character.	Date.	V. — Ar. Interval.	V. — Ar. Rate.	Date.	Ar. — G. Interval.	Ar. — G. Rate.	Date.	G. — Ab. Interval.	G. — Ab. Rate.	Date.	Date.	Date.	Mean date of Kew and Stony-hurst.	Interval.	Rate.
	Jan.		Jan.	Day. o.		Jan.	Day. o.		Jan.	Day. o.		Jan.	Jan.	Jan.	Jan.	Day. o.	
1	1·65	Min.	1·83	18	53	2·10	27	22	2·25	15	34	1·84	2·10	2·10	2·10	26	41
2	2·47	Max.	2·72	25	38	2·84	12	49	2·90	06	85	2·55	2·73	2·76	2·75	20	53
3	2·86	Min.	2·98	12	79	3·30	32	18	3·48	18	28	2·94	3·10	3·14	3·12	18	59
4	3·48	Max.	3·77	29	33	3·91	14	42	3·99	08	63	3·50	3·79	3·80	3·80	30	35

Similar tables having been formed for the whole of the normal movements in the 7 years, and the means found, the following results were obtained:—

TABLE III.

Velocity of Translation of Barometric Changes in miles per hour.

Year.	Number Observed.	Valentia to Aberdeen course.				Falmouth to Leicester course.	Computed rate of motion across centre of country.	Average rate of movement.
		Valentia to Armagh.	Armagh to Glasgow.	Glasgow to Aberdeen.	Mean Rate.	Mean Rate.		
MINIMA.								
1869	32	67	56	46	55	67	67	64
1870	31	47	36	44	43	46	44	42
1871	36	63	39	50	49	61	57	55
1872	47	47	40	54	47	54	52	49
1873	36	49	44	43	46	58	51	47
1874	35	49	43	37	42	64	53	44
1875	42	49	43	42	44	53	49	47
Means ..	37	53	43	45	47	58	53	50
Total	259							
MAXIMA.								
1869	8	64	47	51	53	66	60	58
1870	16	57	55	58	56	42	48	51
1871	7	60	65	80	67	64	67	69
1872	16	50	58	75	61	62	60	59
1873	11	49	42	34	42	62	53	48
1874	8	65	43	50	53	55	50	48
1875	17	56	41	48	53	65	61	56
Means ..	12	57	50	56	55	59	57	56
Total	83							

Mean Average Rate = 53

Table III. shows:—

1. That the average rate of horizontal motion of barometric changes in their progress across the British Isles is about 58 miles per hour.

2. That the mean rate does not vary to any considerable extent from year to year.

3. That the maxima travel with somewhat greater velocity than the minima.

4. That the rate of horizontal motion is slightly diminished as the change passes northward. This is also proved by the fact that the mean velocity along the Valentia—Aberdeen track, is slightly below that over the Falmouth—Leicester track.

With the view of showing the relative frequency of the different velocities of movement along both tracks, a summary of the total number of disturbances, grouped according to rate, is given in Table IV.

This table affords evidence that by far the greater number of barometric changes traverse the country at rates between 80 and 60 miles per hour, and that transits at the higher velocities are somewhat infrequent. Much greater weight must, however, be attached to the values obtained

TABLE IV.

Relative frequency of rates of movement of Barometric Changes.

Miles per hour	10—19	20—29	30—39	40—49	50—59	60—69	70—79	80—89	90—99	100 and above
Valentia—Aberdeen Track.										
Maxima ..	1	30	61	56	41	15	9	6	5	1
Minima ..	0	8	7	28	16	6	8	4	2	4
Totals ..	1	38	68	84	57	21	17	10	7	5
Falmouth—Leicester Track.										
Minima ..	1	19	27	40	36	7	16	13	5	20
Maxima ..	0	9	13	9	12	4	3	3	3	7
Totals ..	1	28	40	49	48	11	19	16	8	27
Average Rates.										
Minima ..	1	18	44	40	35	11	9	13	2	1
Maxima ..	0	4	5	16	19	7	4	2	3	2
Totals ..	1	22	49	56	54	18	13	15	5	3

from minima than to those given by maxima; the former, being generally better defined than the latter, can have their positions on the curves fixed with greater accuracy.

The mean SW-NE velocity of 53 miles per hour, if resolved into N and S and E and W velocities by the ordinary method of the parallelogram of velocities, gives a resulting movement of 38 miles per hour in a West-East direction, precisely confirming the deduction arrived at in my "British Association 1878" paper, and I therefore think it may be safely concluded that this is the normal rate at which barometric changes traverse the British Isles.

It must be remarked that the above results are based solely upon consideration of the changes from rising to falling barometers, and *vice versâ*, the absolute height of the mercurial column at which the turn takes place being in no case considered, but as the barograph curves are automatically reduced to the uniform temperature of 32° Fahr., the effect of variation of air temperature upon the barometers is eliminated.

I would, however, desire it to be distinctly understood, that the results of the present investigation are only brought forward as approximate values. More accurate data than those furnished by the 'Quarterly Weather Report' engravings may perhaps be forthcoming when opportunity serves for a discussion of the original photographic traces, which are free from the

numerous errors necessarily inseparable from reproduction in the reduced form in which they are published.

DISCUSSION.

Mr. C. HARDING said that he feared the real nature of this paper would be misunderstood, and he failed to see its value in its present form. He did not consider that Mr. Whipple had made it at all clear that this was not a discussion of the passage of storm-centres or barometric minima and the centres of high pressure. He could not see that the results obtained supported Mr. Whipple's 'British Association, 1873,' paper. He should much rather prefer seeing the motion of barometric changes worked from the 'Daily Weather Reports,' than from the 'Quarterly Weather Reports.' As a guide to the rate at which storms or weather systems travel, reference was made to Professor Loomis's 12th paper as containing valuable information on this special question.

Mr. PEARSE had noticed that the rate of the change was more rapid in the south than in the north: this he thought might be due to a portion of the northern line being over the channel, this being also the part of the line where the rate of advance was several miles per hour less than the rate between Valentia and Armagh. And this was the more interesting as agreeing with Professor Loomis's observation as to the retardation of the progress of storm-centres across the Atlantic as compared with their rates across the American and European continents.

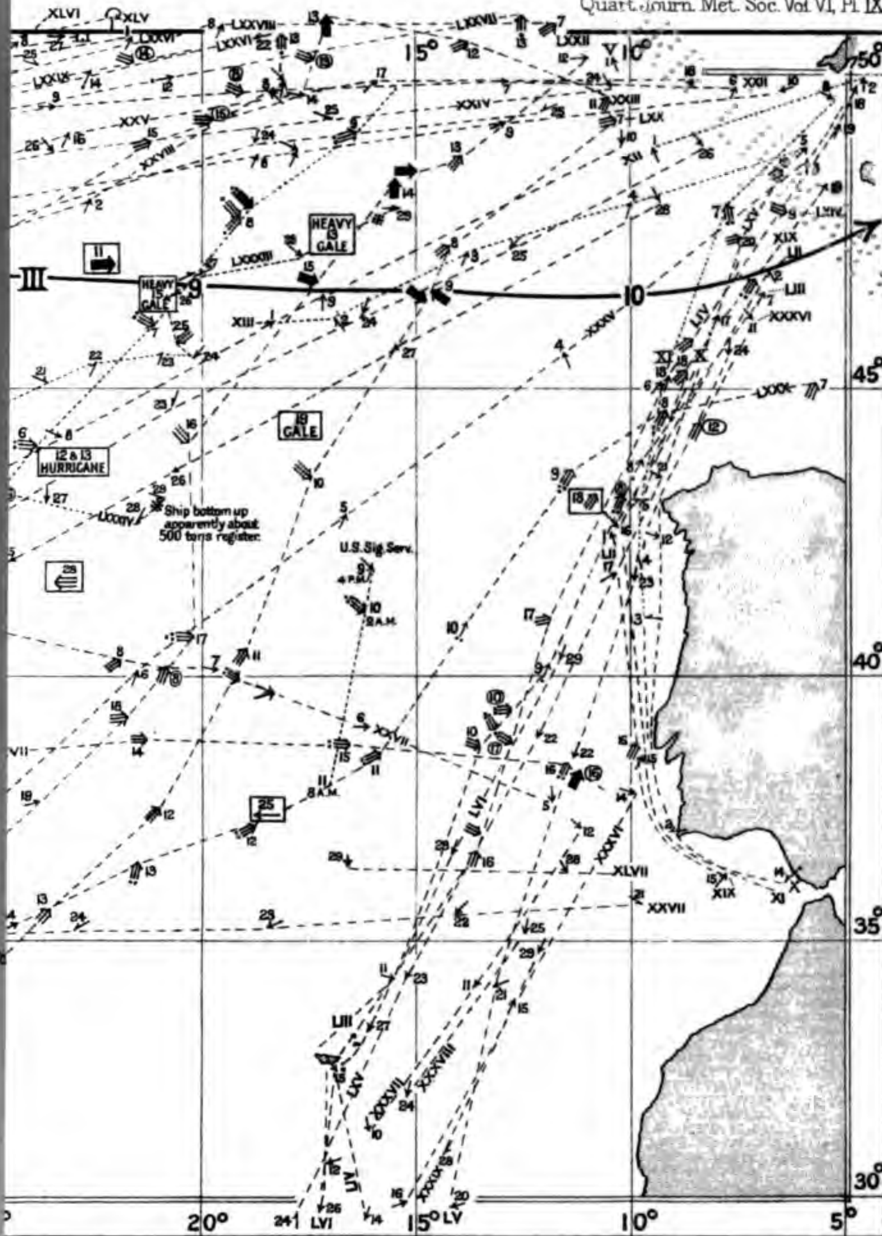
Mr. GASTER, from a brief glanse at the paper, expected that its statements referred to the motion of what are commonly known as "depressions;" but, as they merely referred to the time of occurrence of the lowest barometer reading at certain stations, without regard to the motion of the low pressure systems prevailing at the time, he naturally felt disappointed, and could not see what was the object of the Author in presenting the Society with such partial information. It would be difficult to prove that such minute oscillations travelled in the manner which the paper indicated, and the velocities given rendered the identity of the "dips" doubtful.

Mr. STRACHAN said that Mr. Harding had been describing, very clearly, a certain line of investigation, while Mr. Whipple had followed quite a different one. Though the ultimate object which Mr. Whipple expected to attain did not seem evident, it could not be said that he had not made his method of working intelligible. However, he thought that following barometric maxima and minima from one to another of certain fixed stations was not so useful as tracing the depressions and elevations of pressure from position to position, as they actually occurred day by day, or interval after interval. Mr. Whipple's method led to exaggerated results, such as a velocity of barometric changes exceeding 100 miles an hour, whereas he did not believe that it ever much exceeded 60 miles an hour.

Mr. BUDD understood that Mr. Whipple had not taken the changes only that passed along the line from SW to NE, but all those that in any way touched it, in fact had measured simple ordinates along an arbitrary line.

Mr. WHIPPLE said that what he had done in his paper was to determine the rate at which the change from a rising to a falling barometer, or *vice versâ*, passed from one station to another, without considering the question of the motion of isobars, which he believed to be another thing altogether, and foreign to the present discussion.

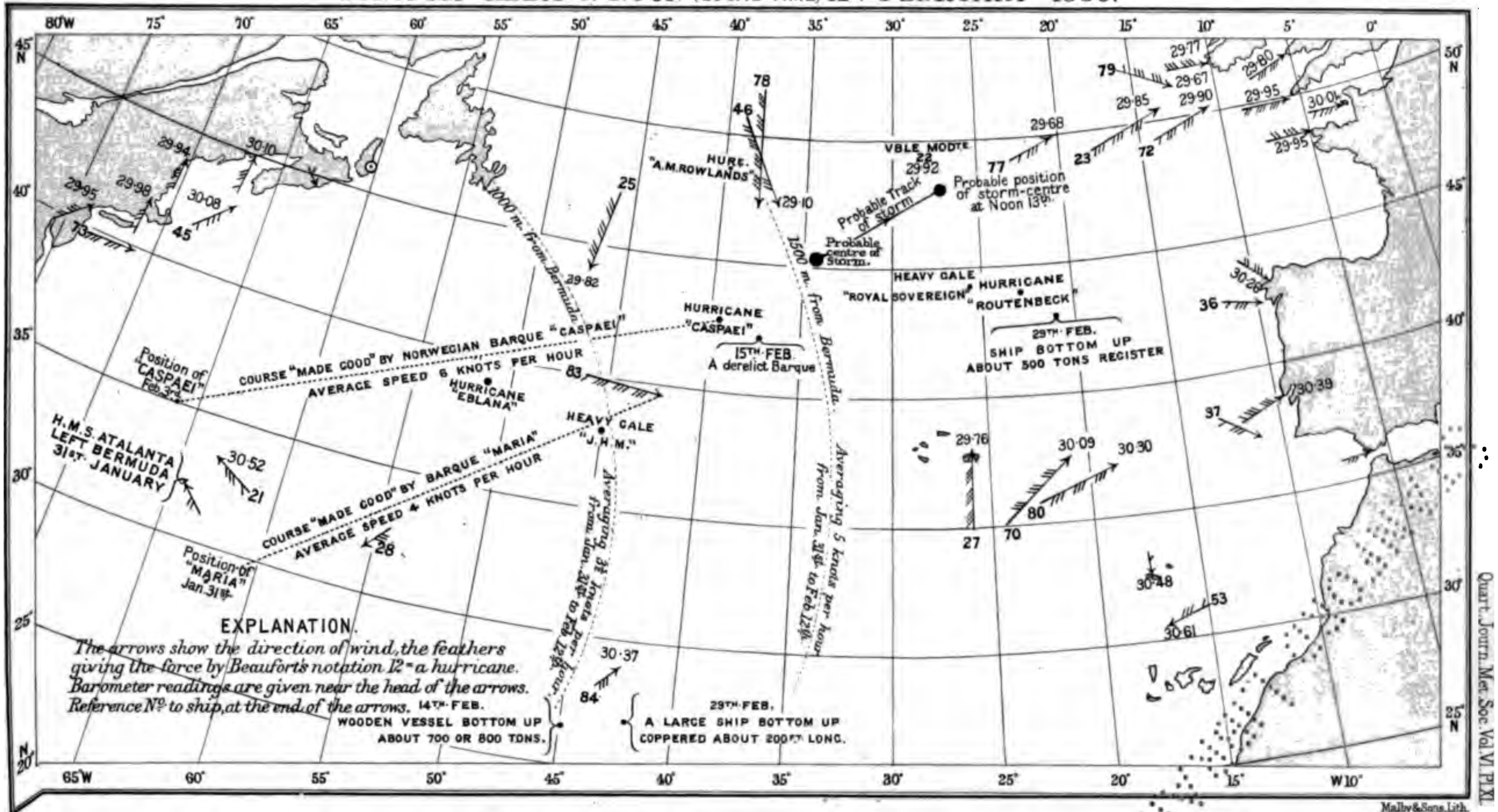
The PRESIDENT (Mr. Symons) said that the only remark he need make was with regard to the scale of the Plates in the 'Quarterly Weather Reports,' which he thought was far too small to yield results of practical value.



Malby & Sons, Lith.

'Lloyd's List.' *The Roman N^os have reference to the name of the ship.*

SYNOPTIC CHART OF NOON (LOCAL TIME) 12TH. FEBRUARY 1880.



Malby & Sons, Lith.

Reference Number used on Charts.	Name of Ship.		Owners, &c.
XXXVI.	Tagus	S.S.	Royal Mail Steam Packet Company.
XXXVII.	Minho	S.S.	
XXXVIII.	Douro	S.S.	
XXXIX.	Guadiana	S.S.	
XL.	Elbe	S.S.	
XLI.	Essex	Barque	Money Wigram and Sons.
XLII.	Kent	S.S.	
XLIII.	Lincolnshire	Barque	
XLIV.	Toowoomba	Ship	Taylor, Bethell, Roberts & Co.
XLV.	Hecla	S.S.	Cunard Steam Ship Company.
XLVI.	Atlas	S.S.	
XLVII.	Tarifa	S.S.	
XLVIII.	Algeria	S.S.	
XLIX.	Malta	S.S.	
L.	Palmyra	S.S.	
LI.	Baltic	S.S.	Captain, through J. Gill, Esq.
LII.	Conway Castle	S.S.	Donald Currie & Co.
LIII.	Warwick Castle	S.S.	
LIV.	Edinburgh Castle	S.S.	
LV.	Duart Castle	S.S.	
LVI.	Dublin Castle	S.S.	
LVII.	Dunrobin Castle	S.S.	
LVIII.	Taymouth Castle	S.S.	
LIX.	Kinfauns Castle	S.S.	
LX.	Nepaul	S.S.	Peninsular and Oriental Steam Navigation Company.
LXI.	Peshawur	S.S.	
LXII.	Verona	S.S.	
LXIII.	Khiva	S.S.	
LXIV.	Chimborazo	S.S.	Orient Steam Navigation Company.
LXV.	Do.	S.S.	
LXVI.	Cuzco	S.S.	
LXVII.	Orient	S.S.	
LXVIII.	Flying Fish	Ship	Scrutton, Sons & Co.
LXIX.	Melba	Brig	
LXX.	Andean	S.S.	West India and Pacific Steam Ship Co.
LXXI.	Naiad	Ship	Captain, through J. Gill, Esq.
LXXII.	Haytian	S.S.	West India and Pacific Steam Ship Co.
LXXIII.	British Empire	S.S.	The British Ship Owners' Company.
LXXIV.	British Crown	S.S.	
LXXV.	Hope	Barque	Captain, through J. Gill, Esq.
LXXVI.	Celtic	S.S.	Ismay, Imrie & Co.
LXXVII.	Baltic	S.S.	
LXXVIII.	Republic	S.S.	
LXXIX.	Adriatic	S.S.	
LXXX.	Cuban	S.S.	W. India and Pacific Steam Ship Co.
LXXXI.	Darling Downs	Ship	Taylor, Bethell, Roberts & Co.
LXXXII.	Winefred	Ship	
LXXXIII.	Maria	Barque	Thos. Daniel Hill.
LXXXIV.	Dallam Tower	Ship	Meteorological Office Logs.
LXXXV.	Dochra	Barque	
LXXXVI.	Victoria Cross	Ship	
LXXXVII.	St. Lawrence	Ship	

Information of a fragmentary nature has also been obtained from many other vessels.

Charts have been drawn for February and March. (Plates IX. and X.) These Charts, which, with the collection of data, constitute the chief part of the work in this paper, show:—1. The proportion of foul weather to fair; 2. The style of weather met with by the several ships; and 3. The parts of the Atlantic where navigation is most common.

The dotted lines are tracks of sailing vessels, and the broken lines are tracks of steamers. The wind is given along the track at each noon (local time), and occasionally at other hours when any important change has taken place. The day of the month is entered adjacent to the noon wind arrow and in some few instances with the wind at other hours, in the latter cases it has been enclosed with a line. An explanation of the different kinds of arrows is given on the Charts. The arrows, &c., enclosed by a rectangle, are from information published in Lloyd's List, where merely a general statement is given of exceptional weather, with the ship's position.

An occasional wind observation has been obtained from the United States Monthly Weather Review:—U.S. Sig. Serv. is affixed on the Chart to all such information.

The thick lines are copied from the United States Monthly Weather Review, and show the Ocean Storm Tracks for the respective months as determined by the United States Signal Service. The bold figures give the day of the month, at 0.43 p.m., G. T., and show for each day the position of the centre of the several storms. The number of ships used to determine these storm tracks is not stated, but in January the logs of 110 vessels were used, so that doubtless a large number would have been used in February and March.

February 1880.

The Chart (Plate IX.) shows that the weather in this month was very stormy. The heaviest gales occurred from the 10th to the 18th, and it would seem that the most severe weather was experienced on the 12th and 13th. I will give a rough abstract from the log of the S.S. 'Utopia' (ref. No. 22.), as a single example of the weather during the month. This is a powerful steamer running to America. On the 8th in about 50° N and 19° W she met a NWly gale, the wind lulled, but on the 9th a strong Wly gale with very heavy hail squalls was noted; on the 10th a fresh storm was met with, commencing from the SEd and blowing with hurricane force, the wind subsequently veered to W; on the 11th the hurricane moderated a little, and on the morning of the 12th the force rapidly decreased. At 6 p.m. the wind had again increased, and at 8 p.m. blew a strong gale from the E;—ship in 49° N and 27° W; at midnight the force lulled to a fresh breeze and continued so till 3.30 a.m. 13th, when the wind burst out from N in a heavy squall, increasing fast to a heavy gale and subsequently to a hurricane, with terrific squalls; the wind moderated in the course of the morning and fell below the force of a gale after 6 p.m. On the 14th, at 8 p.m., another gale set in from the W and blew till the 16th, 10 a.m. On the 16th, at 10 p.m., in 45° N and 44° W another gale set in from E, veering to SSW by midnight and blowing till 5 p.m. of the 17th. The 18th commenced with a SWly gale, which blew till 4 a.m. on the 19th, the wind veering to WNW. On the 20th, at 1 p.m., in 42° N and 55° W, another gale set in from WNW and continued till 8 a.m. of the 21st.

From this it would appear that the 'Utopia,' outward bound, experienced

no fewer than 8 different gales, between the 8th and 21st, whilst running through about 38° of longitude.

Table I. has been formed showing the gales recorded by the different ships in the limits of the Chart on each day of the month—each day's observations are arranged in order of longitude, commencing with the easternmost. The strongest force, with its direction noted during the day, has been given in this Table. The force is expressed in Beaufort's notation, 8 being a fresh gale, 9 a strong gale, 10 a whole gale, 11 a storm, and 12 a hurricane.

This Table shows that it is not uncommon for two or more gales to be blowing in the Atlantic on the same day: the 12th and 13th clearly show this. It will also be observed that a gale blew in the Atlantic every day throughout the month excepting four—these being the 21st, 24th, 26th, and 27th.

The data used for this paper generally confirm the storm tracks (in thick black lines on Chart) given by the U.S. Signal Service, but a very slight examination of the Chart (Plate IX.) makes it evident that there were several other storms in the Atlantic besides those shown by General Myer, and we might reasonably suppose that a further examination of other ships' logs, received at a later period, would still add to the number.

The following are extracts from the Logs, and give information which cannot be shown on the Charts. The same reference number is used here as on the Charts, and precedes each extract :—

I. 20th, 10 a.m., in 37° N and 33° W, heavy squall, force 10, lasted 30 mins. 22nd, noon, in 39° N and 32° W, wind SW 4 ; 1.30 p.m. wind shifted suddenly to NW and N, force 9.

X. 16th, in 48° N and 10° W, 11.30 a.m., shift of wind to NW, previously SSW, force 5 ; 6 p.m. wind SW 6, squall and shift to NW.

XIV. 7th, 4 a.m., in 45° N and 22° W, wind WNW, shifted to N, with heavy squall, and veered to NW.

XXII. 6th, in 50° N and 6° W, dense fog in early morning. 11th, in 49° N and 28° W, shipped a very heavy sea, bursting in mess room door, and filling the same, &c. 13th, in 49° N and 30° W, day commenced with a fresh variable breeze and heavy cross sea, lightning in NW ; 2.20 a.m. wind veered to N ; 3.30 a.m. wind burst out from N in a heavy squall, increasing fast to a heavy gale ; 4.30 a.m. blowing a hurricane with terrific squalls from N ; 5.25 a.m. shipped a very heavy sea.

XXIII. 11th, in 50° N and 11° W, 8 p.m., strong SW gale, with very heavy squalls, shipping much water. 13th, in 51° N and 15° W, 5 a.m., strong SSE gale, heavy sea, shipped a sea, &c. ; 6 a.m. hove ship to on port tack (vessel is a powerful steamer); 8 a.m. terrific gale from S, very heavy sea ; 4 p.m., in 51° N and 17° W, terrific hail squalls.

XXV. 12th, in 44° N and 47° W, 6 a.m., increasing gale, with hurricane squalls ; 8 a.m. mountainous sea, shipping heavy bodies of water, 4 bullocks washed overboard. 16th, 10 p.m., in 49° N and 20° W, barometer 28·40 ins. (uncorrected), no wind of any force experienced.

XXVII. 10th, in 40° N and 26° W, 1 a.m., ship labouring and rolling

TABLE I.—Showing the Gales recorded by the different Ships in the North Atlantic during February 1880.

Date.	Lat. N.	Long. W.	Gale. Direction.	Gale. Force.	Reference Number to Ship.
Feb. 1	46°	18°	SW	8	13
"	33	39	NE	8	21
"	45	42	S b W	10	26
2	50	26	SW	8	73
"	50	27	W	9	45
"	50	28	SSW	9	76
"	44	43	SE b S	9	26
3	50	31	WSW	9	73
"	49	34	SW	9	76
"	40	69	?	9	Lloyd's List
4	48	35	WSW	8	45
"	42	47	W	10	Lloyd's List
"	40	67	?	11	"
5	44	34	SW	9	28
"	47	38	WSW	9	45
"	48	40	W	8	73
"	45	46	W	9	76
6	51	14	SW	9	46
"	44	24	SW & W	9	14
"	42	36	W	8	28
"	46	40	W	9	45
"	47	42	WNW	8	73
"	44	51	W	10	76
7	45	6	SSW	8	80
"	48	8	S b E	8	11
"	50	10	SW	8	70
"	51	12	WSW	8	78
"	40	20	WNW	9	27
"	46	21	WNW	8	14
"	40	38	SSW	9	28
"	35	51	SSW NNE	8	83
8	50	4	SE	8	11
"	45	9	SSW	9	80
"	43	10	SSW	8	53
"	47	14	SW	8	70
"	48	19	SW & NW	10	14
"	40	22	SW b W	9	27
"	36	48	NW	9	83
"	34	52	WNW	8	21
9	48	6	WNW	10	64
"	43	11	SSW	10	80
"	40	12	WSW	9	53
"	47	15	ESE NW	11	70
"	49	16	WSW	8	14
"	49	24	W	9	22
"	41	26	W b N	9	27
"	50	27	SSW	8	78
"	50	30	WNW	9	46
"	37	46	SSW	9	83
10	39	13	NW	9	53
"	42	16	NW	10	U.S. Sig. Ser.
"	43	17	NW	10	70
"	49	27	SSE	11	22
"	40	27	WSW	9	27
"	49	32	SSW	10	78
Feb. 10	48°	33°	W	10	46
"	44	36	?	10	Lloyd's List
"	47	37	W	9	77
"	38	44	NW	9	83
"	43	57	NW	8	45
"	41	60	WNW	8	73
11	45	8	SSW	9	36
"	50	11	SW	9	23
"	39	16	WSW	9	80
"	40	19	SW	9	70
"	47	22	W	11	Lloyd's List
"	49	27	W	11	22
"	49	29	W	10	77
"	48	33	WNW	10	46
"	48	33	SSW WNW	11	78
"	39	42	SSW	9	83
12	51	14	WSW	9	23
"	37	19	WSW	9	80
"	38	21	SW	9	70
"	49	22	W	10	77
"	44	23	?	11	Lloyd's List
"	44	25	?	10	"
"	38	26	SSE	10	27
"	50	28	E	9	22
"	47	37	N	10	46
"	47	38	NW NNE	12	78
"	43	39	?	11	"Caspaei"
"	49	40	?	11	Lloyd's List
"	39	42	SSW WNW	10	83
"	38	45	?	10	Lloyd's List
"	44	47	N b E	9	25
"	39	?51	?	11	Lloyd's List
13	51	12	S	10	77
"	49	14	SW	9	72
"	47	17	?	10	Lloyd's List.
"	51	17	SSE S	9 11	23
"	51	18	S	9	79
"	37	21	SSW	9	80
"	44	23	?	11	Lloyd's List
"	36	24	SW	8	70
"	48	25	SW NW	11	Lloyd's List
"	39	26	WSW	8	27
"	49	32	N	11	22
"	42	32	?	12	Lloyd's List
"	44	35	W	11	"
"	47	39	WNW	9	46

ABLE I.—Showing the Gales recorded by the different Ships in the North Atlantic during February 1880.—*Continued.*

Date.	Lat. N.	Long. W.	Gale. Direction.	Gale. Force.	Reference Number to Ship.	Date.	Lat. N.	Long. W.	Gale. Direction.	Gale. Force.	Reference Number to Ship.
	°	°					°	°			
Feb. 13	39	41	WSW	8	83	Feb. 17	33	35	W	8	1
,,	46	43	W	11	78	,,	34	39	SW b W	8	84
,,	34	68	SW	8	21	,,	46	42	W	8	79
14	48	15	S	11	72	,,	45	45	SW	8	22
,,	50	17	W	9	23	,,	44	52	W	10	Lloyd's List
,,	39	21	W	8	27	,,	43	53	WNW	8	46
,,	50	23	WNW	9	79	,,	42	53	NW	9	76
,,	40	26	?	8	Lloyd's List	,,	40	56	NW b N	8	26
,,	48	36	W	8	22	,,	41	65	NW	8	78
,,	41	40	WSW	9	83	18	46	7	SW b S	9	19
,,	39	47	?	9	Lloyd's List	,,	45	9	SSW	8	54
,,	44	47	SSE / N	8	78	,,	43	11	SW	? 9	Lloyd's List
15	39	17	W	9	27	,,	39	22	W	10	72
,,	47	17	WNW	11	72	,,	41	27	WSW	10	Lloyd's List
,,	47	21	?	10	Lloyd's List	,,	46	29	W b S	9	23
,,	49	21	W	9	23	,,	44	29	WSW	9	83
,,	49	30	WNW	9	79	,,	38	29	WNW	10	Lloyd's List
,,	42	37	W	9	83	,,	35	35	W b N	10	1
,,	47	41	W b N	9	22	,,	37	36	W	10	84
16	40	10	SSW	8	61	,,	35	39	NW b W	8	33
,,	39	10	SSW	8	19	,,	43	43	NNW	10	Lloyd's List
,,	38	12	SSW	11	27	,,	43	46	NW	9	76
,,	37	14	SSW	8	54	,,	44	47	WNW	9	22
,,	44	20	NW	10	72	,,	44	47	N	9	79
,,	47	25	W b S	9	23	19	49	6	SW	9	65
,,	33	29	WSW	10	80	,,	45	18	?	? 8	Lloyd's List
,,	42	34	NW	9	83	,,	36	34	WNW	8	1
,,	48	36	WNW	9	79	,,	36	37	WNW	9	33
,,	46	43	W b N / E / SSW	9 / 8 / 9	22	,,	46	40	NNW	9	76
,,	43	52	WSW	8	46	,,	43	52	NW	8	79
,,	45	56	S	8	Lloyd's List	20	47	7	WSW	9	65
,,	41	62	NW b N	9	26	,,	37	33	N b W	10	1
17	42	10	WSW	8	19	,,	42	55	WNW	8	22
,,	41	12	WSW	8	54	22	39	32	NNW	9	1
,,	41	20	W	10	72	23	43	58	NE	9	23
,,	47	26	SW	9	23	25	46	21	NE	8	83
,,	44	27	?	11	Lloyd's List	28	42	23	E	9	Lloyd's List
,,	43	30	W	9	83	29	47	26	W b N	8	1

most fearfully. 12th, in 38° N and 26° W, noon, S gale just commenced, furious squalls; 8 p.m. heavy SSE gale, with tremendous sea. 15th, in 38° N and 14° W, midnight, ship rolling most fearfully and shipping much water. 16th, in 38° N and 12° W, high sea, ship labouring fearfully, and shipping immense bodies of water, hove ship to on port tack.

XXVIII. 5th, in 43° N and 34° W, 3 p.m., wind SW, suddenly shifted into the WNW, with heavy rain; 10 p.m. a severe squall from SSW. 6th, in 42° N and 35° W, 8.45 a.m., ship struck by a heavy sea aft, carrying

away about 30 feet of the main rail, &c. 7th, in 40° N and 38° W, noon, blowing a terrific gale (wind column does not show such a strong force); 1 p.m. shipped a sea, doing slight damage. 10th, in 34° N and 48° W, 4 p.m., wind SW by W, shifted suddenly in a rain squall to WNW.

LIV. 16th, in 37° N and 13° W, 3 p.m., shift of wind to WNW (previously SSW 8), hard squalls; 10 p.m. fierce squalls; midnight, frequent violent squalls.

LX. Not given on Chart. Skirting coast of Spain 1st to 3rd, outward bound, light S winds and calm.

LXI. Not given on Chart. Homeward bound from Gibraltar; experienced a fresh SSW gale on the 16th, in 39° N and 9° 30′ W, with heavy squalls.

LXII. Not given on Chart. Homeward bound from Gibraltar; experienced moderate W and NW winds throughout from 20th to 24th.

LXIII. Not given on Chart. Homeward bound from Gibraltar to 40° N; moderate E and NE winds on 28th and 29th.

LXIV. 9th, in 48° N and 6° W, 8.40 a.m., a heavy sea struck the ship, carrying away steam launch, 5 boats, davits, galley skylight, engine room skylight, and doing various other damage, washing overboard two able seamen and one passenger. This vessel put back to London for repairs.

LXX. 9th, in 47° N and 15° W. The ESE wind increased into a hurricane, with a sudden shift to NW at 4 p.m.; carried a very high sea down to lat. 26° N.

LXXIII. 5th, in 48° N and 40° W, No. 1 Life Boat struck by a sea and damaged.

LXXXIII. 12th, 6 a.m, in 39° N and 42° W, wind veered suddenly round to WNW (from SSW), and blew a very heavy gale, hove to on starboard tack; 8 a.m. blowing very heavy from W by N, carried away main-topsail sheet, &c. 12th, noon, in 40° N and 42° W, labouring and straining very heavily, almost on her beam ends. 15th, 10 a.m., in 42° N and 38° W, passed the wreck of a barque, apparently American build, loaded with timber. No one being on board we kept on our course. 18th, 2 a.m., in 44° N and 29° W, shipped a heavy sea over the stern, stove in the after part of the cabin; 10 a.m. shipped another heavy sea, and smashed the starboard boat all to pieces. 29th, in 48° N and 15° W, passed a vessel's lower mast painted white, and part of a small boat painted black, and keel up.

LXXXIV. 29th, 11 a.m., in 48° N and 21° W, passed a wreck bottom up, seemed to have been in that position but a short time, apparently about 500 tons register; had mast and jibboom alongside.

A few extracts have been made from 'Lloyd's List' of the most important notices; they supplement in a remarkable way the wind data given on the Chart.

'Oriente.' 14th, in 27° N and 45° W, wooden vessel, bottom up, about 700 or 800 tons; appears to have been some time in water. Date and position given on lower margin of Chart. (Plate IX.)

'Drumpark.' 29th, in 27° N and 42° W, passed a large ship, bottom up, coppered, appeared to be about 200 feet long. Date and position given on lower margin of Chart.

'Eblana.' 3rd, in 39° 32′ N and 69° W, a heavy gale, increasing to a hurricane the following day, and causing the vessel to lay over with the upper dead-eyes of the port rigging under water. 6th, in 39° N and 64° W (see Chart), passed a quantity of wreckage, weather moderate. 12th, hurricane, causing vessel to lay over as before; jettisoned part of cargo. 14th, in 39° N and 47° W, passed a quantity of broken spars, &c., heavy gale blowing.

'Guiding Star.' 4th, in 42° N and 47° W, a succession of violent gales set in from SW to WNW, with high seas. Sails blown all to pieces, bulwarks washed away, thrown on her beam ends. Stormy weather up to 20th, when St. Catherine's Point was sighted.

'Constance.' 9th, 60 miles NW of Ushant, terrific hurricane from SW and heavy sea. Ship went down.

'Cordova.' 10th, in 44° N and 36° W, severe rotary gale (see Chart) and high cross sea. Stove 2 boats, &c., lay-to 6 hours.

'Monarch' S.S., left Newcastle Jan. 31st, put back to Cardiff Roads 19th Feb. On 10th and 11th driven in hurricane. Cargo shifted and decks swept.

'Nauphante.' 11th, in 47° N and 22° W, hurricane from W (see Chart), decks swept, &c.

'J. H. M.' 12th, in 38° N and 45° W, heavy gale (see Chart), damaging severely.

'Routenbeck.' 12th and 13th in 44° N and 23° W, encountered a hurricane (see Chart), had to cut away topsails from the yards to get the vessel righted, having been thrown on her beam ends; everything movable washed off deck.

'Scottish Chief.' 13th, in 47° N and 17° W, heavy gale (see Chart). Thrown on her beam ends and had to jettison cargo.

'Reynard.' 13th, in 44° N and 35° W, hurricane from W (see Chart), lost bulwarks, sails, &c. The 'Virginia' in the same gale had her decks swept.

'Wimmera.' 13th, in 42° N and 32° W, hurricane of unusual violence (See Chart), swept decks; on 15th, passed vessel's top and lower masts, and some rails painted white, apparently of vessel about 1,200 tons.

'Thomas Stephens.' 15th, in 46° N and 21° W, heavy gale (see Chart) and sea. Sea carried away boats and gutted cabin. Jettisoned 100 tons of cargo.

'Lammermoor." Passed Azores on 15th; heavy gales and high sea to Cape Clear.

'G. L. Walters.' 16th, in Bay of Biscay, W heavy gale, with heavy sea, hove to.

'Varuna.' 17th, in 44° N and 27° W, struck by lightning in a hurricane (see Chart), set fore top-mast on fire, had to cut away. The 'Rio Grande' was in same gale, lost spars and yards. Gale lasted till 19th.

'Cambrian Prince.' 18th, in 41° N and 27° W, heavy gale from WSW (see Chart), frightfully high sea.

'Britannia.' 18th, in 38° N and 29° W, lost fore and main topmast and jettisoned cargo.

The 'Times' reports:—'General Shipley,' 14th, in 43° 35′ N and 32° W, sighted a ship on fire. A vessel was seen eight miles off, and it was thought probable she had the crew on board.

At Bermuda the winds were generally light throughout the month, the force of a strong wind was only reached on the 25th and 26th.

The French 'Bulletin International' gives the weather at Funchal, Madeira, for 8 a.m. and 6 p.m. daily. It shows that the wind attained the force of a gale on 10th, 6 p.m., direction N; 16th, 8 a.m., direction SE; 23rd, 8 a.m., direction E.

As the storms, which affect the British Islands, come to us almost without exception from the Atlantic, it may be interesting to give a brief notice of the result of an examination of the 'Daily Weather Reports,' published by the Meteorological Office.

6th. An area of low barometer, or storm-centre, passing west of our Islands on a NE track, causing a S gale at all the Western Stations.

7th. A subsidiary disturbance in Irish Channel, causing a gale in neighbourhood.

9th. Storm-centre in Irish Channel and passing over to central England and apparently then filling up—this gave rise to a strong gale at the Western Stations.

11th. A storm-centre skirting the Western coasts causing a strong gale at the Westernmost Stations.

13th and 14th. A storm-centre skirting the Western coasts causing a strong gale at the Western Stations.

15th. Similar conditions to the 13th and 14th, but a fresh disturbance.

16th. A storm-centre passing northward over Ireland, causing a gale at all British Stations.

18th and 19th. A storm-centre skirting the Western Coasts, but the force of a gale only reached at one or two Stations.

26th. A storm-centre over the North Sea, causing Northerly gales over England.

28th. A storm-centre over South of Norway and the North Sea, causing NEly gales over Scotland.

Six storm warnings were issued for England by the 'New York Herald:' the first four of these seem to have been fully justified, both by the weather in the Atlantic and on our own coasts.

March 1880.

The Chart for March (Plate X.) shows that the weather throughout the month was very stormy, the heaviest gales appear to have occurred about the 12th and 20th.

Table II. shows the position of the gales for the several days of the month, arranged as in the Table for February.

LE II.—Showing the Gales recorded by the different Ships in the North Atlantic during March 1880.

ate.	Lat. N.	Long. W.	Gale. Direction.	Gale. Force.	Reference Number to Ship.	Date.	Lat. N.	Long. W.	Gale. Direction.	Gale. Force.	Reference Number to Ship.
rch 1	° 51	° 12	W	9	48	Mar. 11	° 39	° 59	WNW	9	47
"	46	25	SW	8	41	"	41	60	ESE / WNW	10	76
"	47	39	SSW	8	46	12	48	28	S	8	23
"	47	40	SW	8	51	"	43	29	S / NW	11	Lloyd's List.
"	45	44	SSW	9	24	"	36	31	SW / W	9	17
2	48	5	SSW	9	63	"	39	32	WSW	8	9
"	48	6	WSW	8	54	"	51	33	SE b S	9	U.S. Sig. Ser.
"	50	11	W	8	25	"	46	36	SW	8	26
"	49	13	SW	10	1	"	45	42	NNW	10	U.S. Sig. Ser.
"	51	16	WSW	9	48	"	45	44	W	9	49
"	48	17	W b S	9	41	13	52	27	SE b E	11	U.S. Sig. Ser.
"	50	20	WSW	9	73	"	42	29	W	11	9
"	45	24	SW	9	Lloyd's List.	"	36	34	WSW / WNW	10	17
3	48	18	SW	9	41	"	45	38	W	9	26
"	45	24	SW	9	Lloyd's List.	"	45	46	W	8	49
"	37	31	SSW	9	47	14	44	23	S / SW	8	9
"	43	53	NW	9	24	"	52	32	?	12	Lloyd's List.
"	36	55	NNW	8	27	"	44	41	W	9	26
4	51	18	SSW	8	46	"	44	48	W	8	49
"	38	34	SSE	9	44	15	43	44	WNW	9	26
"	38	36	S / WNW	9	47	16	48	17	S b E	9	9
"	42	57	SW	10	51	"	37	28	SSW	8	50
"	37	58	SSW	8	27	"	42	49	WNW	8	26
5	51	21	SW	9	76	17	49	15	SE b S	10	9
"	48	25	S / WNW	8	25	"	37	30	NW	8	50
"	38	37	WNW / SSW	9	47	"	36	53	SW	9	17
6	51	16	SSW	8	49	"	41	54	W	8	26
"	50	28	SSW / WNW	9	76	18	51	11	ESE	9	9
"	38	42	SSW	9	47	"	43	49	W	9	24
7	51	23	SSW	10	49	"	36	53	SW / NW	9	17
"	48	34	SW	9	76	"	41	57	NW	9	26
"	47	36	SSW	9	25	19	43	45	W	9	24
"	46	43	SW / NW	9	48	"	36	60	SE	9	17
"	38	44	SW	9	47	"	38	63	S	10	Lloyd's List.
8	50	26	S	8	49	20	38	32	ESE to SSW	11	Lloyd's List
"	36	37	NW	8	30	"	37	43	SW	8	50
"	46	39	SW	10	76	"	32	45	SSW	8	31
9	50	25	ESE	9	22	"	41	50	SW	11	28
"	48	31	ENE	8	U.S. Sig. Ser.	"	37	52	?	10	Lloyd's List.
"	49	33	NW	8	49	"	31	53	W	8	69
"	38	52	? S	9	47	"	42	55	W	8	48
10	50	23	SE b E	9	22	"	37	58	S / NW	11	Lloyd's List.
"	47	36	NW	8	49	"	42	58	NW	11	U.S. Sig. Ser.
"	39	58	SW	9	47						
11	36	30	SSE	8	17						
"	36	33	S	8	9						
"	45	43	SW	10	49						
"	45	43	SW	11	U.S. Sig. Ser.						
"	46	45	?	11	Lloyd's List.						
"	42	54	? W	9	25						

TABLE II.—Showing the Gales recorded by the different Ships in the North Atlantic during March 1880.—*Continued.*

Date.	Lat. N.	Long. W.	Gale. Direction.	Gale. Force.	Reference Number to Ship.	Date.	Lat. N.	Long. W.	Gale. Direction.	Gale. Force.	Reference Number to Ship.
	°	°					°	°			
Mar. 20	38	62	?	10	Lloyd's List.	Mar. 25	49	28	WNW	10	8
"	36	62	SW / WNW	11	17	"	41	36	WNW	8	43
"	41	62	NNW	12	76	"	34	42	SSW	9	69
21	51	9	E b S	8	9	"	38	57	W	8	50
"	38	13	NE	8	15	"	37	66	NW	10	21
"	36	14	N b W	8	58	26	44	22	NW b N	8	6
"	46	34	SE b S	9	24	"	44	24	NW	9	31
"	40	36	WSW	9	8	"	49	27	NW b W	8	8
"	40	42	S / NW	11	Lloyd's List.	"	34	42	? SW	9	69
"	33	42	SSW	9	31	"	38	59	WNW	8	50
"	37	45	W	9	50	"	39	61	NW	9	Lloyd's List.
"	42	49	WNW	8	48	"	37	62	NW	10	21
"	41	49	WSW / WNW	11	28	"	33	79	S	8	U.S. Sig. Ser.
"	32	50	SW	8	69	27	44	21	NW	10	31
"	41	56	NNW	12	76	"	34	77	SW	8	U.S. Sig. Ser.
"	37	65	NW	8	17	28	45	17	?	10	Lloyd's List.
22	41	35	W	10	8	"	39	51	SW	8	21
"	35	39	SW	8	86	"	41	58	W	9	47
"	37	41	W	8	35	"	36	60	?	11	Lloyd's List.
"	42	42	WNW	11	28	"	39	64	SW	9	50
"	36	43	W	8	43	"	33	72	SW	12	75
"	44	43	WNW	8	48	"	35	75	SW / NNW	8	U.S. Sig. Ser.
"	37	47	W	10	50	29	53	26	S	10	U.S. Sig. Ser.
"	32	49	WNW	9	69	"	46	42	SE	9	22
23	45	32	S / W	9	8	"	40	49	SW	9	21
"	37	37	WNW	10	31	"	41	56	WNW	10	47
"	39	38	W	10	35	"	42	59	SW / NW	10	U.S. Sig. Ser.
"	39	38	WSW	8	81	"	35	73	NNW	8	U.S. Sig. Ser.
"	37	38	WNW	9	86	30	59	13	SSE	10	8
"	45	43	NNW	8	76	"	49	27	W	8	49
"	32	48	WNW	8	69	"	52	31	WSW	9	U.S. Sig. Ser.
24	48	14	SE	10	Lloyd's List.	"	38	67	?	11	Lloyd's List.
"	46	31	W b N	10	8	"	34	68	N b W	11	75
"	40	31	WNW	9	31	"	40	70	NE	8	50
"	41	32	WSW	8	81	"	35	73	NNW	8	U.S. Sig. Ser.
"	37	61	SW	10	Lloyd's List.	31	50	5	SW	8	6
"	40	73	W / NW	10	17	"	59	12	SSE	10	8
25	48	14	SE	10	Lloyd's List.	"	50	22	W	8	49
"	49	26	W	8	22						
"	42	26	NNW	10	6						
"	42	27	W	10	31						

It will be seen that a gale was blowing every day throughout the month.

Two or more distinct gales were blowing at the same time in the Atlantic on several days during the month; this is notably the case on the 21st, 24th and 25th.

The following extracts contain matter which cannot be shown on the Charts:—

III. 16th, in 47° N and 7° W, dense fog set in, which continued without interruption till the evening, when it cleared a little, never, however, entirely taking off till the following noon (17th).

VI. 23rd, in 36° N and 34° W, 4 a.m., wind SW by S, force 6, sudden shift of wind to W by N, force 7, wind hauling back when squall passed. 24th, in 40° N and 29° W, passed numerous pieces of timber. (See Chart).

VIII. 19th, in 38° N and 38° W, 2 p.m., wind WSW 5,—a squall in which the wind flew to N and NE—lasting 15 minutes.

IX. 18th, in 42° N and 29° W, 10 a.m., wind suddenly increased, large nimbus clouds passing over from SW, out of which the wind came with hurricane force, thunder, and very vivid lightning, and hail very large, as if it were broken ice. 14th, in 48° N and 25° W, passed 4 casks, apparently petroleum casks—not long in the water.

XVII. 11th, in 36° N and 30° W, midnight, fresh gale from SSE, high sea, ship rolling heavily, and at times taking large bodies of water over all. 12th, 5 a.m, wind shifted suddenly in a fierce squall to W (from SW). 20th, in 36° N and 62° W, tremendous sea, making clean breaches over ship. 21st, 7 a.m., in 36° N and 63° W, black nimbus clouds rising to NW; shortly afterwards observed three whirlwinds, quite close to ship (ahead), put helm hard-a-starboard, so that the largest one just passed clear of ship on starboard quarter; after which two vivid flashes of lightning, and two claps of thunder, with heavy rain for 15 minutes. 24th, in 40° N and 73° W, blowing a whole gale from W and NW, and freezing hard; the ship one mass of ice, the spray freezing as it fell on deck and rigging.

XXI. 26th, in 37° N and 61° W, passed some wreckage. (Description not given.)

XXII. 5th, in 48° N and 40° W, shipped a tremendous sea, smashing life boat, &c.

XXIV. 26th, in 50° N and 10° W, dense fog came on at noon, lifting a little at 6 p.m.

XXV. 2nd, in 50° N and 11° W, mountainous sea. 7th, in 47° N and 36° W, strong SSW gale, terrific squalls at times, found the cargo in between decks had shifted through excessive rolling; 8 p.m. hard gale, with hurricane squalls, mountainous sea.

XXVIII. 20th, midnight, in 41° N and 50° W, blowing a terrific gale and mountainous sea. 21st, a.m., commenced with a terrific gale and a fearful high cross sea, decks constantly full with water fore and aft; in fact, ship completely buried in the high cross sea that was running. Officer's berths and cabins full of water, destroying all clothes, &c.; 2 a.m. washed away one life boat and pinnace; in morning found cargo had settled to port side; 4 p.m. every article movable washed off the decks; cabin sky light broken, &c. 22nd, in 42° N and 48° W, 9 p.m., wind SSW; 10 p.m. wind shifted to WNW, with a moderate breeze; 10.30 p.m. wind came away with a fearful gust, blowing at a hurricane force and a tremendous high sea. 23rd, 8 a.m., shipped a heavy sea, starting in end of forward house.

XLIV. 3rd, in 35° N and 37° W, heavy SE squalls, ship labouring and straining fearfully, and shipping great quantities of water.

XLVIII. 23rd, in 47° N and 34° W, passed the barque 'Ulster,' abandoned.

L. 28th, in 39° N and 65° W, shift of wind to WNW, from SSW, in a moderate gale.

LXIII. 3rd, experienced a hard SSW gale at entrance to English Channel.

LXVI. Outward bound, *viâ* Madeira, from 7th to 11th, moderate wind, chiefly S. (No room on Chart.)

'Lloyd's List' contains the following important notices:—

'Lake Nepigon.' 8th, in 46° N and 32° W, narrowly escaped collision with a derelict 3-masted, all masts and yards aloft, a dark dirty night, and blowing. (See Chart.)

'Spain.' 12th, in 43° N and 29° W, hurricane from S to NW, carried away main-stay sails, &c.

'Frances.' 13th, in 49° N and 27° W, lost yards, &c.

'Josephine.' 14th, in 52° N and 32° W, a severe hurricane, lost all upper spars.

'Balgay.' Left New York 17th, and arrived at Bermuda 22nd. On the night of the 18th encountered a revolving hurricane, and lost a mast.

'General Birch.' 19th, in 38° N and 63° W, strong S gale; a.m. of 20th, wind went to WNW, increasing at noon to a perfect hurricane and tremendous sea; swept decks and washed man overboard.

'Queen of Hearts.' 20th, in 38° N and 62° W, running in a heavy gale broached-to, lost her masts and water logged.

'Victor,' Norwegian Barque. 20th, in 37° N and 58° W, encountered a hurricane from S to NW, and was compelled to abandon the vessel.

'Nenuphar.' 20th, in 38° N and 32° W, hurricane from ESE to SSW, thrown on beam ends, and compelled to cut away spars, afterwards abandoned.

'Able.' 21st, in 40° N and 42° W, gale from S to NW, lost masts, &c.

'Jerusalem.' 24th, in 48° N and 14° W, heavy gale from SE, terrific squalls, continued till 10 p.m., when it suddenly changed to SW, and cleared up.

S.S. 'Enmore,' arrived at Halifax N.S. 26th; had experienced a succession of heavy gales, and had to lie-to 63 hours in 43° N; a heavy field of ice on the bank.

'Ben Lomond,' S.S. 28th, in 45° N and 17° W, heavy gale and sea, carried away foremast and main-top mast, &c.

'Hamilton.' 28th, in 36° N and 60° W, very heavy gale, swept decks, and had to put into Fayal.

'Pierremont,' S.S. 30th, arrived at Boston from Hartlepool. On the 20th, terrible hurricane, lasting 36 hours, decks swept.

'Lady Lawrence.' New York to Liverpool; had to put back. 30th, in 38° N and 67° W, a hurricane for 36 hours; on her beam ends for 10 hours, swept decks, and lost masts, &c.

'Henry' (ship). Passed Bermuda, March 16th, 58 days from Liverpool, for St. John's.

'Neckar.' 28th, in 48° N and 26° W fell in with the derelict barque 'Ulster.'

Numerous notices are given of ice in the vicinity of the banks of Newfoundland.

The U.S. Signal Service Storm Tracks show far fewer storms in the mid-Atlantic than can be obtained from the data used for this paper; the same fact was noticed in February, so that it seems probable that the Signal Service Tracks have been drawn from data not well distributed.

The winds at Bermuda were very light throughout the month and only attained the force of a strong wind on the 30th.

At Funchal, Madeira, only two gales are recorded during the month.—23rd, 8 a.m., direction N, and 28th, 6 p.m., direction NNW.

The 'Daily Weather Reports' of the Meteorological Office show the following disturbances for the British Islands.

1st. A storm-centre to the north of Scotland, travelling E, causing Wly gales at northern Stations.

2nd and 3rd. A SW gale blowing in the South of England:—*This* is apparently caused more by an area of high pressure to the South than by the area of low pressure to the North.

6th. A storm-centre skirting the West Coasts, causing Sly gales at westernmost Stations.

18th and 19th. A W gale blowing at Scilly, centre of disturbance apparently to SW.

21st. Similar conditions to those on 18th and 19th.

31st. A storm-centre to the West of the Hebrides, causing a strong Sly gale at the Scottish Stations.

The 'New York Herald' issued 7 warnings for England for the month of March.—5 of these were failures and 2 successes; besides which, two gales affecting our coasts were not warned. The failure may be greatly due to the high barometric pressure and Ely winds which prevailed generally over the British Isles, causing the storm-centres, approaching from the Atlantic, to have a more Nly track than was reckoned upon.

Final Remarks.—With especial reference to H.M.S. 'Atalanta,' she left Bermuda on Jan. 31st, and has not been since seen; it appears probable that she would not have met with any exceptionally severe weather earlier than about Feb. 12th or 13th, and allowing that she had averaged from 5 to 6 knots per hour on her homeward course, she would, at that date, have inevitably encountered a severe hurricane—since the extent of the storm was from 48° N and 40° W to considerably SE of the Azores, a belt which, it may reasonably be supposed, every vessel homeward bound from Bermuda would necessarily traverse. A heavy gale was noted on the 12th in 38° N and 45° W which is in the direct homeward bound track from Bermuda, and if the 'Atalanta' had only averaged 4 knots per hour on her homeward course, she would have fallen in with this gale; it was doubtless part of the storm referred to above, but the information on the Chart is scant in the immediate neighbourhood.

The storm of the 12th and 13th may fairly be considered as about the most severe during the two months here dealt with.

It may be remarked that the Norwegian barque, 'Caspaei,' was north of Bermuda on the 3rd and was in the full force of the gale on the 12th, her distance *made good*, averages 6 knots per hour, and shows that the winds were favourable for a homeward passage from Bermuda.

The correspondence from H.M.S. 'Salamis,' published in the 'Times' of May 6th, states:—On the authority of the Captain of the 'Caspaei,' on Feb. 12th, in lat. 42° 43′ N, long. 39° 25′ W, while running before the wind he encountered the severest gale he had ever experienced. The ship would not steer, and could not be prevented from broaching-to. She was thrown on her beam ends, and remained so for 19 hours, the cargo of cotton keeping her afloat. Several ships were in sight at the time of the commencement of the gale and were unable to lay-to on account of its suddenness.

The barque 'Maria' (No. 33 on the Feb. Chart), also affords valuable data for the probable track of H.M.S. 'Atalanta,' on Jan. 31st she was in 28° 40′ N and 62° 4′ W and homeward bound, on Feb. 12th she was in 39° 36′ N and 41° 55′ W, hove to in a "very heavy gale and almost on her beam ends," she seems to have been too far west to feel the full force of the hurricane.

The track of the 'Maria' is probably slightly to the south of that taken by the 'Atalanta,' and the 'Caspaei's' track is probably about as much to the north; the course and distance made by the two vessels prove beyond a doubt that if the 'Atalanta' were afloat on Feb. 12th, and if making a direct homeward course, she would have been in the midst of a severe hurricane.

A Synchronous Chart has been drawn for noon, Feb. 12th (Plate XI.), which would seem to show that the centre of the storm was at this time in about 45° N and 35° W, in the direct homeward track from Bermuda, and would be reached by a vessel leaving Bermuda on January 31st, and averaging 5 knots per hour on a direct course. The storm was travelling to the ENE, apparently at the rate of about 16 miles per hour, the probable track is shown on Plate XI.

A Synchronous Chart has also been drawn for noon, February 11th, and this contains no evidence of the existence of the violent storm which blew on the 12th; it will also be seen that the storm-track given by the U.S. Signal Service does not show this storm to have commenced on the 11th.

The 'Maria' was sugar laden and evidently a slow sailor, but she averaged 4 knots per hour on her homeward course between Jan. 31st and Feb. 12th. Frequent mention is made in her log of bad weather and heavy gales between Feb. 7th and 12th, but the fact of her not heaving-to before the 12th seems a strong proof that the weather in this locality was not sufficiently bad to wreck a well found ship. The track on the Feb. Chart showing the winds experienced by the 'Maria' (No. 33) testifies, with other data, to the stormy nature of the mid-Atlantic between the 12th and the 18th. The 'Maria' passed a derelict barque—American build, loaded with timber, on Feb. 15th, in 42° N and 37° 30′ W (see Chart).

The 'Dallam Tower' passed a wreck bottom up on Feb. 29th, in 43° 13′ N and 20° 57′ W (position shown on Chart—ship's No. 84).

Lloyd's List has two reports of a wooden ship bottom upwards, one in 27° N and 45° W on Feb. 14th, the other in 27° N and 42° W on Feb. 29th, this may have been the same ship as that seen on the 14th, though the reports differ (see p. 148.) I suppose it is *possible* that this ship may have been the 'Atalanta,' as she was built of wood and coppered—she was 950 tons register; however, judging from the position, it would seem highly improbable. The positions of these ships are shown on the lower part of Plate XI.

I regret that paucity of data renders this paper so elementary, but it is a satisfaction to know that very much more valuable data could be collected for these two months, if time and labour were devoted to the work, and my endeavours will be fully rewarded if this paper leads the way to a more elaborate investigation by means of daily synchronous Charts for the whole of the North Atlantic, for the months of February and March 1880; such work would doubtless prove instructive, and I am of opinion that it would tend to real progress in the discovery of laws which govern storms in the British Islands.

The Meteorological Office has discussed the weather of the North Atlantic for August 1873.* A study of that publication gives a thorough insight into the changes that were going on over the North Atlantic in that month, which doubtless will serve as a general type for August of any year. It shows a general circulation round the area of high pressure in mid-Atlantic throughout the whole month, over-riding all smaller and subsidiary disturbing causes.

In concluding, I must express my thanks to the Meteorological Council, and to Mr. Scott for granting ready permission to use all existing data in the Meteorological Office; also to the Companies and Owners for their courteous treatment, all to whom I have applied having without exception facilitated my work to the utmost; and in the case of Owners at outports, have furnished gratuitously extracts from their Ships' Logs; the names of these gentlemen will be found with the list of ships.

DISCUSSION.

Captain Toynbee said that the sudden disappearance of a ship having the national importance of the 'Atalanta' painfully illustrated to every one's mind a case which is far too common, but which is not generally known, viz. that of "missing ships." There is a large number of "missing ships" (Mr. Jinman says over 70) which disappear every year, causing sad blanks in many hundreds of homes. He hoped that the grievous loss of the 'Atalanta' might bring the subject prominently before the public mind, and strengthen the hands of those who are endeavouring to devise means for preventing such losses, as no doubt many are preventible. He thought that Mr. C. Harding's paper clearly proved

* The Meteorology of the North Atlantic during August 1873, by Capt. Henry Toynbee, with 31 Synoptic Charts (1878).—Potter, 31 Poultry, and Stanford, Charing Cross.

that there was extremely bad weather in the Atlantic about the middle of February; it also showed the position of two wooden ships bottom upwards, either of which might possibly have been the 'Atalanta,' though the probability was not very strong. It was impossible to discuss thoroughly the weather of the Atlantic during the months of February and March until more data had been collected, but he hoped that this paper would lead to the subject's being taken up, and that we should have a complete discussion of Atlantic weather for at least a year. Not only would it tell us more about the weather experienced by "missing ships," but it would enable us to answer the very important meteorological questions which relate to the possibility of warning the Coasts of Europe from America. He considered that as a very large proportion of the Atlantic trade is in the hands of the English, they are in the best position for doing the work; in fact, if it is done at all, they must collect the greater part of the data, which is the chief part of the work; and as "to be forewarned is to be forearmed," he would recommend that the data of a *coming* year should be dealt with, so that captains might be told that their logs are going to be borrowed, and asked to be specially careful with their observations.

Mr. SCOTT said that Mr. Harding had remarked on the extremely disturbed state of the atmosphere over the Atlantic during the spring, while we had experienced very quiet and cold weather. He would remind the Fellows of the very unusual conditions prevalent last winter, when the extraordinary temperature of —23° was recorded at Blackadder, near Coldstream, on December 4th. This very winter had been so mild in New York that the residents could not fill their ice houses from the water near that city. When such contrasts of temperature co-existed, it was natural that great atmospherical disturbances must be produced. As a general rule anticyclonic weather over these Islands might be taken as an indication of the existence of cyclones off our coasts. It would not be forgotten that at the time of the 'City of Boston' storm in February 1870, the barometer had read as high as 31 ins. at St. Petersburg at the time that it ranged as low 27·3 ins. on board the R.M.S. 'Tarifa,' in 24° W.

Prof. ARCHIBALD remarked that he had seen it reported that the past winter in Iceland was the warmest on record. This, if true, would well accord with all that Mr. Scott had said.

Mr. STRACHAN thought it very desirable to have more than one synchronous chart for each day, as the actual course of a storm's progress during a day might be quite different from its mean course. Until some great hurricane were followed up and studied from synchronous observations at intervals of six or four hours, meteorologists would never be able to meet all the objections raised by Mr. Jinman and others to the received laws of storms. He believed that the western half of a cyclone is descending air, especially the north-west wind; and when that was proved, they would probably be able to account for the sudden squalls and changes of wind at present inexplicable. As so many scientific gentlemen devoted themselves to inventing anemometers, he suggested to them to devise an anemometer which would measure the vertical, up or down, motion of the air.

The PRESIDENT (Mr. Symons) said that he had long pleaded for daily synchronous charts of the Atlantic; those published by the United States Signal Office were based on so few observations that it was impossible to accept them. He thought that all the European nations ought to take part in working up the weather of the Atlantic and publishing synchronous charts, as all were alike interested in this subject: he believed that such charts would be of inestimable value in forecasting European weather. With regard to the mild winter in New York, he believed it extended over all the States and in Canada.

Mr. HARDING said that it seemed to him quite possible for England to undertake the investigation of the Atlantic weather by means of daily synchronous charts; the cost would not be as large as was generally supposed. England, doubtless, could best obtain the necessary data; and in the event of any other country undertaking the work, he thought we should have to supply the bulk of the material.

New Form of Six's Self-registering Thermometer. By JOSEPH WARREN ZAMBRA, F.M.S.

[Read April 21st, 1880.]

THE Thermometer known as "Six's Self-registering Thermometer," is for general purposes a favourite instrument with the public. In making a Six's thermometer, the bulb and part of the tube are filled with alcohol, an index to register the minimum is then placed in that portion of the fluid contained in the tube, in continuation of the column of alcohol is an inverted siphon of mercury, and this again is followed by a second column of alcohol, into which the second, or maximum, index is placed. The tube being bent and placed bulb upwards, when the alcohol contracts the mercury recedes, pushing before it the minimum index, which is carried upwards by the mercury to the lowest temperature reached; and a similar action takes place with the maximum index when the thermometer is acted upon by heat.

Nothing could be more simple or more convenient than this instrument, were it not that in extreme cold pure alcohol frequently develops air-bubbles in the tube, causing erroneous indications. The alcohol which fills the thermometer bulb contains air, which the pressure of the atmosphere is sufficient to keep in its place, if the thermometer be left open. The thermometer, however, is closed, to prevent evaporation of the alcohol contained above the mercury on the maximum side of the instrument, which alcohol is necessary for the maximum index to float in. When the point of the instrument is hermetically closed at a given temperature, a certain amount of air is contained in the bulb above the maximum index; this air exerts a pressure on the mercury and alcohol inside the tube sufficient to keep the thermometer in adjustment; should, however, the temperature to which the thermometer is exposed be much below that at which it was closed, the liquid contracts and the air expands, its pressure is thereby diminished, and it no longer has sufficient power to keep the air fixed in the alcohol of the thermometer bulb; this, therefore, escapes and rises to the bend in the tube, where it separates the column, causing, as before stated, erroneous readings. To prevent this accident it is usual to seal Six's Thermometers hermetically at a *very low temperature*, whilst immersed in a freezing mixture many degrees below the point at which they are likely to be used. If this is carefully done, they will act perfectly. Thermometers, however, are sometimes made, in the manufacture of which sufficient care has not been taken by the workmen to get the necessary degree of cold to keep them in adjustment when acted upon at a temperature 20° or 30° below the freezing point of water.

The first thought which occurred when considering the matter of getting equal pressure was to leave the thermometer open to the atmosphere. A number of instruments were thus made, and used for a long time; and, although passing through a very cold period, not one of them went out of adjustment from the cause named; but from those thermometers the top

bulbs of which were filled with pure alcohol, the alcohol evaporated, while other fluids, such as creosote, glycerine, and dilute acids, were decomposed, and presented a very objectionable appearance, at the same time preventing the indices from moving freely in the tube either with or without the magnet.

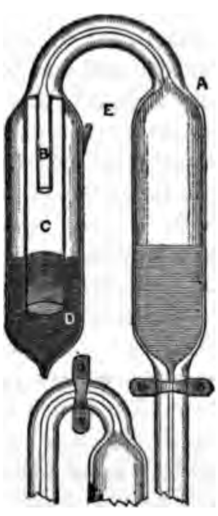
The next step resulted in the following contrivance:—The thermometer, an ordinary Six's, is fitted with a tube in continuation of the top bulb; to this tube is attached a reservoir similar in size to the bulb; this reservoir contains mercury, and the continuous tube is made to dip into it, forming a mercurial joint. There is also a contrivance to prevent the mercury being forced back into the alcohol; and the reservoir has a small opening to the atmosphere near the top. Thus arranged, the alcohol in the thermometer is under the ordinary pressure of the atmosphere, and evaporation is cut off by the intervention of mercury.

In the ordinary instrument the mercury does not always move freely, but hangs in the tube—resulting in the two columns, maximum and minimum, not always indicating exactly the same temperature.

These improved thermometers have been in constant use during the late excessively cold weather, and have remained in perfect order.

It also appears from observation that the column of mercury is more consolidated under this equal pressure, and moves more uniformly than it does under *confined varying* pressure.

There are various forms in which the improvement can be carried out, all involving the same principle; and either of which can be applied to those thermometers now in use.



No. 1.

No. 2.

The Wood Engravings, Nos. 1 and 2, exhibit the improved arrangement Six's Thermometer.

In each drawing at A is shown the point where the ordinary Six's Thermometer tube is sealed off from the action of the atmosphere. B shows the continued tube terminating inside the cylinder, C, the end of which cylinder dips into mercury contained in an outer cylinder, D, open at E to atmospheric pressure.

DISCUSSION.

Mr. WHIPPLE said that he knew from experience that Six's thermometers often went wrong, and were very easily broken. Mr. Zambra's instrument would probably supersede the old form, and he believed it would give very good results.

Mr. STRACHAN considered that the improvement would serve the purpose intended. He had had a Six's thermometer with the terminal bulb open under his care for the last 20 years; and it showed that the mercury became oxidised and dirty.

Mr. ZAMBRA said that he should have much pleasure in presenting two of these thermometers to the Society.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

MARCH 17th, 1880.

Ordinary Meeting.

GEORGE JAMES SYMONS, F.R.S., President, in the Chair.

Sir A. P. BRUCE CHICHESTER, Bart., Arlington Court, Barnstaple;
WILLIAM HUGH COCHRANE, 27 Norfolk Road, Regent's Park, W.;
Rev. HENRY GARRETT, M.A., Ivy Bank, Highfield, Southampton;
HENRY JONES, 4 Whitehall, S.W.;
JOSEPH LINGWOOD, Bondgate, Alnwick;
Lt.-Col. LLEWELLYN WOOD LONGSTAFF, F.R.G.S., Ridgelands, Wimbledon;
Rev. C. E. SHERARD, New Athenæum Club, Suffolk Street, S.W.;
JAMES H. STEWART, Alnwick; and
W. J. TREUTLER, M.D., F.L.S., Fletching, Uckfield,
were balloted for and duly elected Fellows of the Society.

The following Papers were read:—

"Comparison of Thermometric Observations made on board the Cunard R.M.S.S. 'Algeria,' by Captain WILLIAM WATSON, F.M.S., during 5 passages between Liverpool and New York, in September to December, 1878." Compiled at the Meteorological Office, and communicated by Captain HENRY TOYNBEE, F.R.A.S., F.M.S. (p. 121.)

"On the Greenwich Sunshine Records, 1876-80." By WILLIAM ELLIS, F.R.A.S., F.M.S. (p. 126.)

The Discussion on Mr. Ellis's Paper was postponed, in order to afford the Fellows an opportunity of inspecting the following instruments:—

OBJECTS EXHIBITED, MARCH 17th, 1880.

1. **Hagemann's Anemometer.**

[*Vide* Quarterly Journal of the Meteorological Society, Vol. V., p. 208.]—*Exhibited by the Cowl Committee of the Sanitary Institute.*

2. **Hagemann's Anemometer,** with dial removed, to show mechanism

Exhibited by the Cowl Committee of the Sanitary Institute.

3. **Station Barometer,** with metal scale.

As the construction of barometers in wooden frames has not hitherto admitted of their being verified, this instrument was designed to remedy the defect, and to unite the ornamental appearance of such a barometer with the accuracy of a metal station barometer. This has been carried out in the following manner;—the cistern, scales and connections consist entirely of metal, and are suspended in a wooden frame, in such a way as to allow of the expansion and contraction of the metal at various temperatures.

The glass tube is furnished with a pipette or air-trap, and is slightly contracted for carriage.

The internal diameter of the cylinder is 0·4 inch. All the conditions required by the Kew Committee and by the Meteorological Office in the manufacture of Station Barometers have been fulfilled, and the latest improvements have been added.

The whole forms an instrument suitable for the Scientific Observer, and one that can be easily read by the general public. *Exhibited by* P. ADIE.

4. **Dines's Hygrometer,** original pattern, for use with iced water.

Exhibited by L. P. CASELLA, F.M.S.

5. }
6. } " new pattern, for use with water or spirit.

[Quarterly Journal of the Meteorological Society, Vol. VI., p. 39.]—*Do.*

7. **Sunshine Recorder.**

This Instrument was exhibited in a rather incomplete form, and is now being modified in several respects with the object of securing perfect efficiency at a minimum of cost. It will, therefore, be better to defer any detailed description until the Instrument is perfected; but the general principle may be mentioned, viz.:—to fix the Glass Sphere on a Polar Axis and provide an adjustment for Latitude for the Sun's declination. *Do.*

8. **Casella's Self-recording Rain Gauge.**

[Symons's British Rainfall, 1878, p. 41.]—*Do.*

9. **Bourdon's Thermograph.** *Exhibited by* B. DONKIN, Jun.

10. **Sunshine Recorder.**

[Quarterly Journal of the Meteorological Society, Vol. VI., p. 83.]

Exhibited by R. J. LECKY, F.M.S.

11. **Cloud Reflector.** (p. 163.)

The Instrument consists of a circular mirror 1 foot in diameter, inclined at an angle of 30°, revolving in a pedestal in the centre of a disc which carries a compass card. Attached to the mirror is an arm on which is mounted a graduated brass arc. On the latter an eye-piece is moved by a rack and pinion, through which the centre of the mirror (on which a cross is scratched) is seen by the observer. The movements of the clouds whose images fall on the mirror are conveniently watched through the eye-piece, and the changes in altitude and azimuth read off by the scale and compass card.—*Exhibited by the* Rev. W. CLEMENT LEY, F.M.S.

12. **Wild's Wind Gauge.**

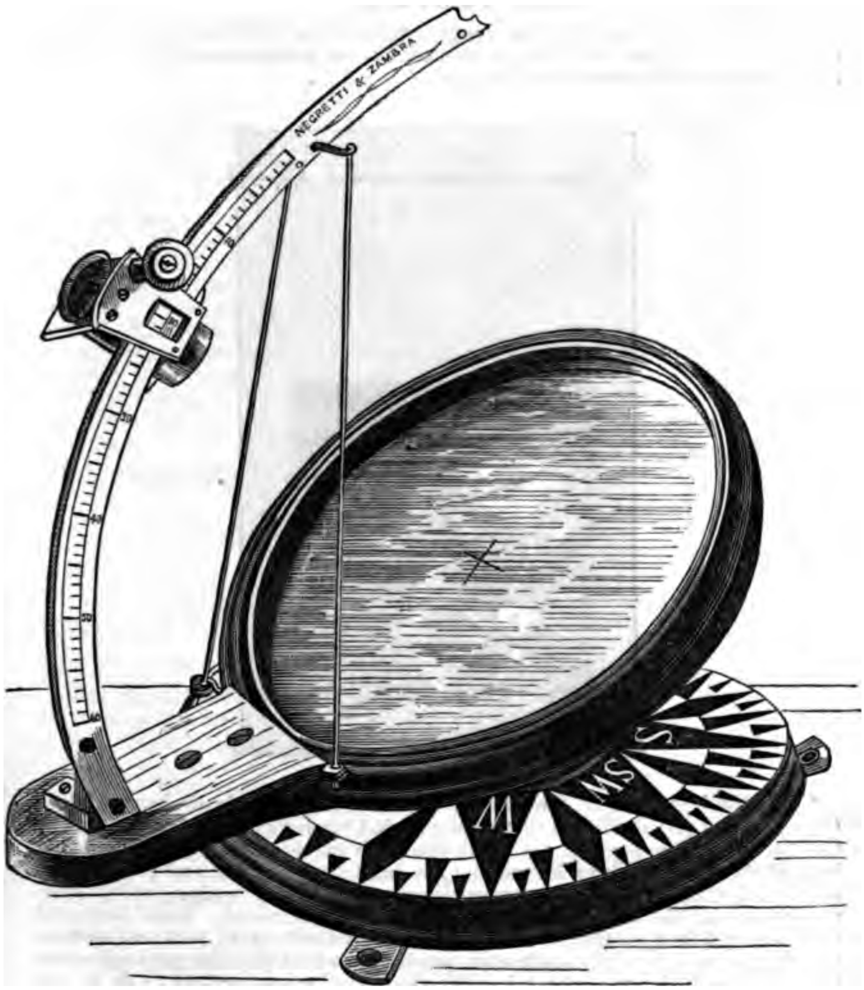
[Repertorium für Meteorologie, Vol. IV., pt. 9, p. 5.]

Exhibited by the Meteorological Office.

13. **M. O. New Fishery Barometer,** with Kew Corrections. *Do.*

14. **Herman and Pfister's Metallic Maximum and Minimum Thermometer.**

[Repertorium für Meteorologie, Vol. I., pt. 1, p. 7.]—*Do.*



LEY'S CLOUD REFLECTOR.

15. Lamont's Atmometer.
[Beilage zum Wochenberichte dem Münchener Sternwarte. No. 158.]
Exhibited by the Meteorological Office.

16. Hagemann's Anemometer.
[Quarterly Journal of the Meteorological Society, Vol. V., p. 208.]—*Do.*

17. Lowe's Hygrometer.
[Quarterly Journal of the Meteorological Society, Vol. II., p. 458.]—*Do.*

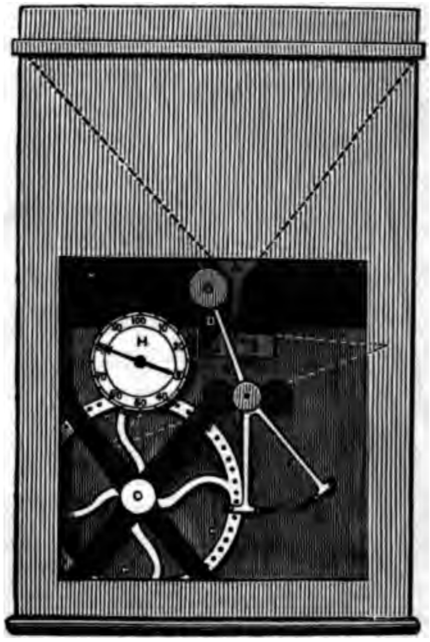
18. Set of Sunshine Cards. *Do.*

19. The Society's Album.
[Quarterly Journal of the Meteorological Society, Vol. V., p. 118.]
Exhibited by G. J. SYMONS, F.R.S., P.M.S.

20. Redier's Barograph.
[Quarterly Journal of the Meteorological Society, Vol. II., p. 412.]—*Do.*

21. An undescribed pattern of Rain Gauge.

The name of the maker of this gauge is not known, and it is believed that no description of it has ever been published, but its construction will be easily understood from the annexed engraving.



(A) is the bottom of the funnel from which the rain water is discharged into a tilting bucket (B) similar to that employed in Crossley's Gauge; on the side of this bucket are two pegs (C, C,) which catch the weighted arm (D) and move it backwards and forwards each time that the bucket tilts. The arms (E) and (F) move with (D), and at their extremities are two curved wedges, which slide under pegs on the wheel (G) and gradually work it round. Each bucketful represents ·05 inch, so that it tilts twice for every tenth of an inch, and as both the wedges have to slide under each peg on the wheel (G), the pegs represent tenths of an inch; the wheel has 50 pegs, and corresponding amounts are marked on the rim of the wheel, and can be read through an opening in the side of the gauge; each complete revolution of the wheel equals 5 inches, and is recorded as 5 on the small dial (H) at the top; this dial reads up to 100 inches.

Exhibited by G. J. SYMONS, F.R.S., P.M.S.

22. Map of, and 14 Photographs of Damage by the Walmer Whirlwind.

[Symons's Monthly Meteorological Magazine, Vol. XIII. p. 145.]—*Do.*

23. Goddard's Cloud Mirror, from the Great Exhibition of 1851.

The mirror is laid on a horizontal support near a window, and fastened so that the point marked N may coincide with the S point of the horizon,—the several points will consequently be reversed. The edge of a conspicuous cloud is brought to the centre of the mirror, and the observer keeps perfectly still until it passes off at the margin, where the true point of the horizon *from which* the clouds are coming can be read off. *Do.*

24. Barometer Adjunct.

This instrument was designed to overcome a difficulty which many observers

experience, more especially when the light is bad, in accurately adjusting the level of the mercury to the ivory point in the cistern of a Fortin barometer. It consists, as will be seen by the engraving, of a small microscope attached to a clamp, which fastens to the lower plate, or any other convenient part of the barometer cistern. It is arranged to slide backwards and forwards to enable the right focus to be obtained; it will turn sideways, and can be raised or lowered so as to suit any ordinary form of Fortin barometer; and owing to these numerous adjustments no care is necessary in selecting its positions, it being immaterial to what part of the cistern it is attached. When once adjusted and focussed to suit the sight of the observer, it of course, needs no readjustment for subsequent observations. In practice it is found to answer its purpose admirably, making the setting of the mercury rather a pleasure than a difficult, and at times doubtful operation.

Exhibited by E. WHITE WALLIS, F.M.S.

25. Copies of Schwabe's Sunspot Drawings.

Exhibited by G. M. WHIPPLE, F.R.A.S., F.M.S.

APRIL 21st, 1880.

Ordinary Meeting.

GEORGE JAMES SYMONS, F.R.S., President, in the Chair.

Rev. JAMES OLIVER BEVAN, M.A., Assoc.Inst.C.E., 72 Beaufort Road, Edgbaston, Birmingham;
FREDERICK E. COBB, Stanley, Falkland Islands;
EDWARD FILLITER, M.Inst.C.E., F.G.S., 16 East Parade, Leeds;
THOMAS LAWRIE GENTLES, Derby;
WILLIAM ARTHUR HARRISON, F.R.G.S., York House, Waterloo, Liverpool;
JAMES WALLACE PEGGS, Assoc.Inst.C.E., 21 Queen Anne's Gate, S.W.;
FREDERICK SLADE, Assoc.M.Inst.C.E., Southbank Road, Kenilworth; and
EDWIN J. C. SMITH, Eltham Green, Kent,
were balloted for and duly elected Fellows of the Society.

The adjourned Discussion on Mr. ELLIS's Paper, "On the Greenwich Sunshine Records, 1876-80," was resumed and concluded.

The following Papers were read:—

"On the Rate at which Barometric Changes traverse the British Isles." By GEORGE MATTHEWS WHIPPLE, B.Sc., F.R.A.S., F.M.S. (p. 136.)

"A New Form of Six's Self-registering Thermometer." By JOSEPH WARREN ZAMBRA, F.M.S. (p. 159.)

RECENT PUBLICATIONS.

AUS DEM ARCHIV DER DEUTSCHEN SEEWARTE. I. Jahrgang: 1878. Herausgegeben von der Direktion der Seewarte. 4to.

This is the first annual publication of the Deutsche Seewarte, and contains a full description of the organisation in Germany, and the observatory at Hamburg. The volume with the appendices extends to 320 pages. Appendix II. contains the Instructions to the Observers of the Deutsche Seewarte.

BRITISH RAINFALL, 1879. On the Distribution of Rain over the British Isles during the year 1879, as observed at about 2,000 Stations in Great Britain and Ireland, with articles upon various branches of rainfall work. Compiled by G. J. Symons, F.R.S. 8vo. pp. 238. 1880.

In addition to the Rainfall and Meteorology of 1879, General Tables of Total Rainfall, Monthly Rainfall at 232 stations, and other information, this work contains articles on the following subjects:—On the observations of Rainfall made at the Royal Observatory, Greenwich, in the years 1841 to 1879, by W. C. Nash.—Snowfall Measurement, by Col. Ward.—Rotherham experimental gauges.—The International Congresses and the size of rain gauges.—On the dimensions of rain gauges, and on the position in which they should be placed, by Dr. H. Mohn.—The Bohemian Rainfall Organisation.—Self-recording rain gauges.—Decrease of rainfall with altitude.

CIEL ET TERRE. REVUE POPULAIRE D'ASTRONOMIE ET DE MÉTÉOROLOGIE. Nos. 5-10. May-July, 1880. 8vo.

The chief meteorological articles are:—Les courants supérieurs de l'atmosphère et leur influence sur les dépressions barométriques, par C. C. d'Espiennes.—La terre et ses montagnes, par F. Van Rysselberghe.—Observations atmosphériques sans instruments, par J. Vincent.—Les orages en Belgique, par J. Vincent.—La rosée, par A. Lancaster.—Phénomènes périodiques naturels, par A. Meuris et J. Vincent.—Quelques phénomènes interessants observés pendant le dernier hiver, par A. Lancaster.—La prévision du temps, par F. Van Rysselberghe.

CONTRIBUTIONS TO OUR KNOWLEDGE OF THE METEOROLOGY OF THE ARCTIC REGIONS. Published by the Authority of the Meteorological Council. Part II. 4to. 1880.

The present Part contains the results of the discussion of a number of logs of vessels either frozen up in winter quarters or drifting with the ice, and therefore refers mainly to the winter season. The observations discussed were made at the Gulf of Boothia, Hudson's Strait, Griffith Island, Assistance Bay, Northumberland Sound, Wellington Channel, Baffin's Bay, and Port Kennedy.

INDIAN METEOROLOGICAL MEMOIRS: being occasional discussions and compilations of meteorological data relating to India and the neighbouring countries. Published under the direction of Henry F. Blanford, Meteorological Reporter to the Government of India. Vol. I. Part IV. 4to. 1880.

Contains:—The Winds of Kurrachee, by Frederick Chambers. This is a discussion of the records of a Robinson-Beckley anemometer for the three years, 1873-75.

JAHRBUCH DER KÖN. UNG. CENTRAL-ANSTALT FUER METEOROLOGIE UND ERDMAGNETISMUS. Unter mitwirkung der Observatoren Ignatz Kurländer und Dr. Ludwig Gruber. Herausgegeben von Dr. Guido Schenzl. 4to. 1879.

In addition to other matter, this gives the monthly and annual means of the meteorological observations at 86 stations; and the results of the phenological observations at 19 stations.

JOURNAL OF THE BATH AND WEST OF ENGLAND SOCIETY AND SOUTHERN COUNTIES ASSOCIATION. Vol. XI. Third Series. 8vo. 1880.

Contains:—The Climate of the South of England in the Agricultural Year 1878-9, and its effects on the Crops, by N. Whitley. The Author remarks that what really crushed the wheat crop was the low temperature and rain during the blossoming time, and the prolongation of the harvest into the cold and frosty autumnal nights, withering the stalk and destroying the vitality of the plant. The late harvest was occasioned, not only by the low temperature of the air, but, also, by the want of heat in the soil; his observations show that the soil in July

was 6° below its mean temperature for that month, and 9° below that of a warm summer. The sea water, also, of the English Channel in this month was 5° below the average. The barley crop suffered less than the wheat, but in general it presented a thin, withered aspect: and only in low and sheltered land did it reach to an average crop. The oat plant bravely stood against the cold and wet, and may be considered an average, and in some parts an abundant crop.

Memoirs of the Science Department, University of Tokio, Japan. Vol. III. Part I. 4to. 1880.

Report on the Meteorology of Tokio for the year 2539 (1879), by Prof. T. C. Mendenhall. The observations were taken 3 times a day, viz. at 7 a.m., 2 p.m., and 10 p.m.; these readings are printed *in extenso* for each day of the year, and are also graphically represented by curves.

Meteorological Observations at Stations of the Second Order for the Year 1878. Published by direction of the Meteorological Council. 4to. pp. 177. 1880.

This contains the daily observations at 9 a.m. and 9 p.m. *in extenso* from 25 stations, and the monthly and annual summaries from 33 stations, in different parts of the United Kingdom.

Proceedings of the Bath Natural History and Antiquarian Field Club. Vol. IV. Part III. 8vo. 1880.

Contains:—The Winter of 1878-9 in Bath, and Seasons following, by the Rev. Leonard Blomefield.

Proceedings of the Royal Society. Vol. XXX. Nos. 203-205. 8vo.

Contains:—On the Height of the Aurora Borealis, by Dr. W. De La Rue, F.R.S., and Dr. H. W. Müller, F.R.S.—On the Constants of the Cup Anemometer, by the Rev. T. R. Robinson, D.D., F.R.S.

Regenwaarnemingen in Nederlandsch-Indië. Eerste Jaargang 1879 door Dr. P. A. Bergsma, Directeur van het Observatorium te Batavia. 8vo. pp. 257 1880.

This is Dr. Bergsma's first annual report of the Rainfall in the East Indian Archipelago, and contains the daily rainfall at more than 120 stations for the year 1879.

Report of the Third Congress of the Sanitary Institute of Great Britain, held at Croydon, October, 1879; also the Calendar and Bye-Laws, being Volume I. of the Transactions. Editors:—H. C. Burdett and F. de Chaumont, M.D., F.R.S. 8vo. 1880.

The Meteorological Papers read at the Congress were:—Address of the President of Section III. on Meteorology, Geology, and Geography, by G. J. Symons, F.R.S.—Rain collected from roofs considered as a Domestic Water Supply, by H. S. Wallis.—On some of the apparent influences of the Weather upon the prevalence or otherwise of certain classes of Disease, by G. Corden.—Eleven months of Cold Weather (Nov. 1878—Sept. 1879), by E. Mawley.—Conditions of the Water Supply of Croydon in relation to its Rainfall and Geology, with suggestions for its sanitary and profitable Improvement, by W. F. Stanley.

Report on the Irrawaddy River. By R. Gordon, M.Inst.C.E., Executive Engineer, Henzada Division. Foolscap folio. 3 vols. 1879 and 1880.

This Report consists of four parts, which are devoted to the following subjects:—I. Hydrography; II. Hydrology; III. Hydraulics of the Irrawaddy; and IV. The Hydraulic Works connected with the Nawoon River. In Part II. Mr. Gordon treats of the summer monsoon and the Irrawaddy Floods; and in the Appendix gives rainfall tables for stations in Burma, and also the weekly results of Meteorological observations made at 13 stations in the province of British Burma during 1875 and 1876.

RESULTS OF RAIN AND RIVER OBSERVATIONS made in New South Wales during 1879. By H. C. RUSSELL, B.A., F.R.A.S., Government Astronomer for New South Wales. 8vo. 1880.

This gives the monthly and annual amounts of rainfall and the number of rainy days at 153 stations in the colony; also the monthly heights of the Western Rivers above the mean summer level. To these tables are appended a map, showing the relative amounts of rain and the positions of the stations; and a diagram, showing the daily state of the Rivers from March, when the observations were commenced, to the end of the year.

THE FORTY-SEVENTH ANNUAL REPORT OF THE ROYAL CORNWALL POLYTECHNIC SOCIETY. 8vo. 1880.

Contains:—Meteorology of West Cornwall and Scilly 1870 to 1879, and Observations of Sea Temperature off Falmouth 1875 to 1879, by Wilson L. Fox.

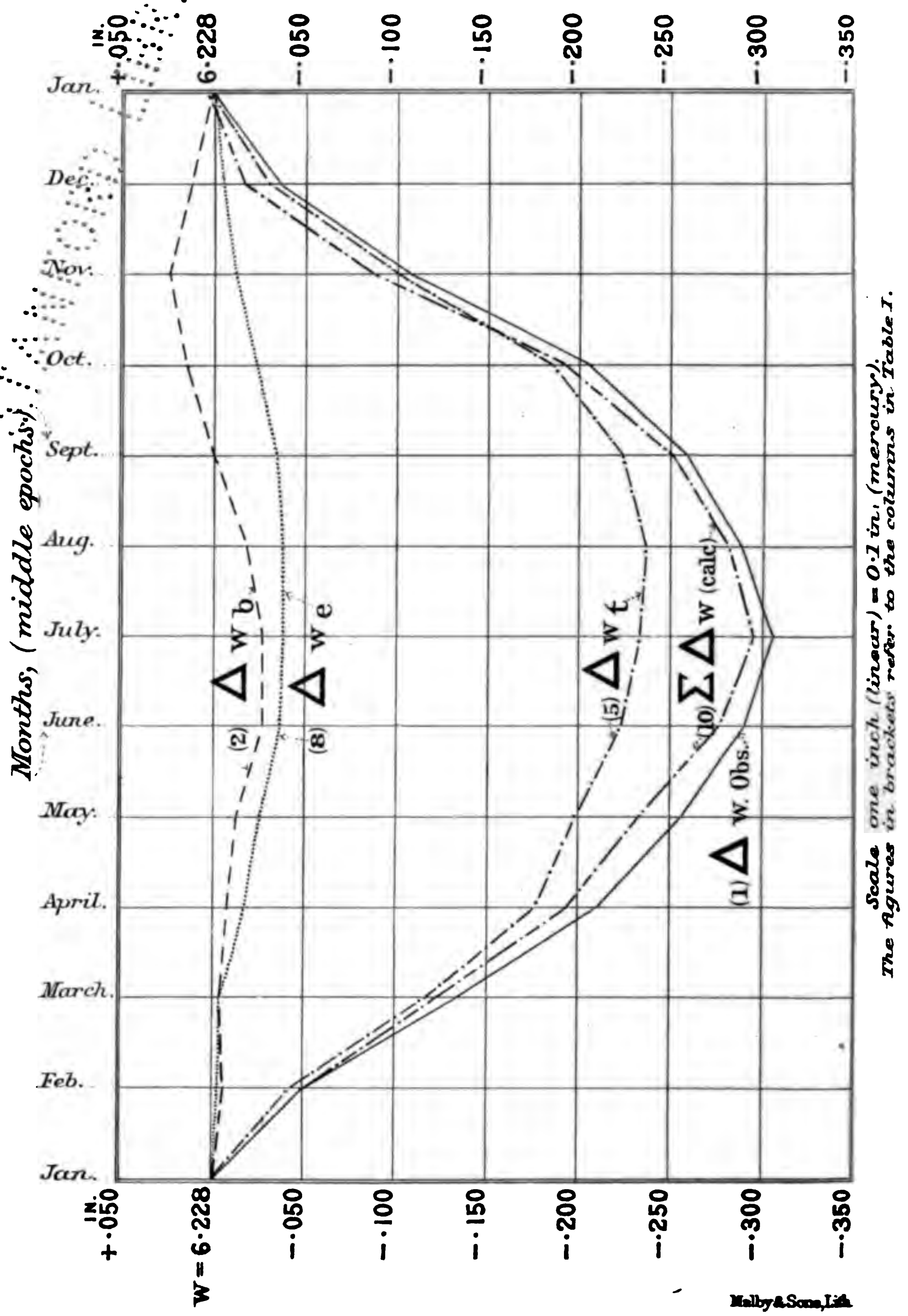
ZEITSCHRIFT DER OESTERREICHISCHEN GESELLSCHAFT FUER METEOROLOGIE. Redigirt von Dr. J. Hann. May-July, 1880. 8vo.

Contains:—Ueber eine Compensation in den Variationen des mittleren Luftdruckes während eines Sonnenflecken-Cyclus zwischen Indien und Russland, von H. F. Blanford.—Bemerkungen zur vorstehenden Abhandlung des Herrn Blanford, von Dr. J. Hann.—Ermittlung einer empirischen Barometerformel, von Prof. Dr. Jordan.—Zur Bestimmung des atmosphärischen Wasserdampfes, von Fr. Rüdorff.—Das Patent-Hygrometer von Klinkerfues, von Prof. Dr. Müttrich.—Der Einfluss des Polareises auf die Bahnen der Depressionen in Europa, von G. F. von Friesenhof.—Meteorologische Beobachtungen in Görz im Jahre 1879 in Vergleichung mit jenen der zehn Jahre 1870-79, von K. F. von Czoernig.—Die jährliche Periode des Regenfalles in Oesterreich-Ungarn, von Dr. J. Hann.—Ueber gewisse extreme Erscheinungen aus der geographischen Verbreitung der Pflanzen, von F. Krasan.

ZEITSCHRIFT DES KÖNIGLICH PREUSSISCHEN STATISTISCHEN BUREAU'S, Jahrgang 1880. 4to.

Contains:—Die Organisation des meteorologischen Dienstes in den Hauptstaaten Europa's, von Dr. G. Hellmann. Zweiter Theil. In this second part, Dr. Hellmann gives an account of the various meteorological organisations, &c., in Russia, Finland, Sweden, Austria, Hungary, Italy, Spain, and Portugal.

Annual Variation in the Barometric Weight (W) of the Air-column between Darjíling & Goalpára.
Vertical height = 6,526 ft.



Malby & Sons, Lith.

QUARTERLY JOURNAL

OF

THE METEOROLOGICAL SOCIETY.

VOL. VI. No. 36.

Variations in the Barometric Weight of the Lower Atmospheric Strata in India. By Prof. E. DOUGLAS ARCHIBALD, M.A., F.M.S. (Plate XII.)

[Read May 19th, 1880.]

IT was maintained by the late Mr. J. Allan Broun, F.R.S., in several articles which appeared in 'Nature' shortly before his decease, that while air must unquestionably expand and contract according as its temperature rises and falls, variation in density so produced in no way adequately accounts for the annual variation of monthly mean barometric pressure at the surface of the earth.

From these articles it would appear that the two most prominent objections raised by Mr. Broun against the supposed connection between temperature and barometric pressure, as far as India is concerned, are (1) that their critical epochs do not in general exactly coincide; the epoch of maximum pressure on the plains usually occurring throughout India in December, while that of minimum temperature generally falls in January, and also the minimum pressure occurring mostly in the month of July, while the maximum temperature is more often reached in either May or June; (2) that the ranges of the oscillations of monthly mean pressure and temperature bear no determinate relation to each other, either as regards locality or time. With respect to the former objection, I showed in 'Nature' (Vol. XX. p. 54) that if we examined the monthly mean barometric weights of the air-columns between several pairs of stations on the plains and at elevations of 6,000 feet and upwards on the hills in India, their maxima invariably occurred in January, their common epoch of minimum temperature. The anomaly in the total pressure on the plains was evidently due to some contrary variation in the atmosphere above the upper stations, probably introduced, as was first suggested by Mr. H. F. Blanford, F.R.S., by the setting in at their level and above, of the warm moist anti-

monsoon upper-current. A similar coincidence is also generally observable in the opposite epochs for the barometric weight and temperature of these lower strata.

If then it can be shown, as I propose to do in the present paper, that the oscillations in the barometric weight of such lower strata, are even closer related to those of temperature, than we should be justified in concluding from the coincidences above referred to alone, and also that such oscillations form a large proportion of the total annual variation of monthly mean barometric pressure on the plains, the first objection put forward by Mr. Broun must evidently be regarded as invalid, so far, at all events, as India is concerned.

For the present I shall defer any definite reply to the second objection, as it would take me somewhat beyond the limits of the subject I propose to deal with more particularly in the present paper, viz. the monthly variations in the barometric weight of an air-column representing a stratum of the atmosphere equal to about one-fifth of the whole (by weight), and their relations to the calculated variations separately introduced by (1) top-pressure, (2) temperature, and (3) humidity.

For this purpose I have subjected the atmospheric column between Goalpára, in Assam, and Darjíling, on an adjacent spur of the Himálayas, to a physical analysis somewhat similar to that given by Mr. Blanford in his valuable monograph on "the Winds of Northern India," published in the Phil. Trans., 1874.

The only advantages claimed for the present analysis over that given in the above work are (1), that the means of the elements employed are calculated from a longer series of observations,* and (2), that the variations in the barometric weight (Mr. Blanford employs the actual density, which is simply proportional to the barometric weight) of the air-column, calculated from the observed variations in its temperature and humidity, are given for successive months throughout the year, instead of merely for those of January and July.

In his paper, Mr. Blanford first of all finds the monthly mean barometric weight of the oblique air-column between these two stations, by taking the differences between the monthly mean barometric pressures at their respective levels, and then calculating from the results thus given, thè corresponding monthly mean densities of the air-column.

A comparison of the actual densities thus obtained, is adapted well enough to an examination of the extreme range of variation, but scarcely answers

* The means of the two principal elements employed in the analysis by (1) Mr. Blanford, and (2) myself are for the following periods respectively:—

	Goalpára. Years (1)	Goalpára. Years (2)	Darjíling. Years (1)	Darjíling. Years (2)
Barometric Pressure	5	8	8	8-10
Temperature	3	8	4	9

The means of all the elements employed in the present paper are taken from 'The Indian Meteorologist's Vade Mecum,' by H. F. Blanford, Calcutta, 1877, Vol. II.

where, as in the present case, the more minute variations from month to month are intended to be shown. I have therefore omitted the calculation of the actual monthly mean densities of the air-column, and have used instead their proportional equivalents, the barometric weights, the variations of which from month to month are numerically indicated on a more appreciable scale.

In the accompanying Table, Δw represents the variation from month to month of w,* the observed monthly mean barometric weight of the air-column between Goalpára and Darjíling. Δt and Δe represent corresponding variations in t and e, the monthly mean temperatures and vapour tensions of the air-column respectively, as derived from the mean of the observations at the 2 stations.

w, t, and e, are given by the formulæ—

$$w = B - b$$

$$t = \frac{t_1 + t_2}{2}$$

$$e = \frac{e_1 + e_2}{2}$$

where B, b, t_1, t_2, e_1, e_2, are the observed monthly mean barometric pressures, temperatures and vapour tensions at Goalpára and Darjíling respectively.

Column (1) gives Δw, as computed from the observed barometric pressures at the upper and lower stations.

Column (2) gives that part of Δw which is solely due to the change of barometric pressure at Darjlíng.

The values in this column are obtained by the formula—

$$\Delta w_b = w_{b_1} - w_b = w_b \quad \frac{b_1 - b}{b} \quad . \quad . \quad . \quad (a)$$

where b, b_1, are successive monthly mean barometric pressures at Darjíling, and w_b, w_{b_1}, the observed barometric weight corresponding to b and the computed barometric weight corresponding to b_1 of the air-column respectively.

Column (3) gives the values in (1) after they have been corrected by those in (2). The figures in this column ought thus to represent the variations from month to month in the barometric weight of the air-column, freed from all variations induced by changes in the pressure of the superincumbent strata.

Column (4) gives Δt, the monthly increment of the mean temperature of the air-column, as computed from the monthly mean temperatures observed at the two stations.

Column (5) gives that part of Δw due to Δt, or change of temperature alone, obtained by the following formula—

* Since w is in every case the mean value for the month, it corresponds to the middle of the month. The period of variation is thus from the *middle* of one month to the *middle* of the next.

$$\Delta w_t = w_{t + \Delta t} - w_t = w_t \frac{-\Delta t}{461{\cdot}2 + t + \Delta t} \quad . \quad . \quad (\beta)$$

Where t, $t + \Delta t$, are successive monthly mean temperatures of the air-column, and w_t, $w_{t + \Delta t}$, the observed barometric weight corresponding to t, and the computed barometric weight corresponding to $t + \Delta t$.

Column (6) gives the differences between the values for Δw, so computed, and those for Δw, derived from the observed pressures, and corrected for top-pressure in column (3).

These differences, which are mostly small, ought theoretically to be due to variations in the amount of vapour present in the air-column.

To test this fact, I have given in column (8) the variations from month to month in the barometric weight of the air-column, introduced solely by changes in the amount of aqueous vapour present, as deduced from the figures representing its mean vapour tension e.

In column (7) are given the values of Δe, the monthly increment of the mean vapour tension of the air-column.

The values in column (8) are obtained by the formula—

$$\Delta w_e = w_{e + \Delta e} - w_e = w_e \frac{\tfrac{3}{8}\left\{ e - (e + \Delta e)\dfrac{460 + t}{460 + t + \Delta t} \right\}^{*}}{B + b - \tfrac{3}{8}e} \quad . \quad (\gamma)$$

in which B, b, represent the barometric pressures at Goalpára and Darjíling respectively corresponding to e and w_e, the observed vapour tension and barometric weight of the air-column between, the pressures and temperatures being assumed constant during the intervals from month to month.

In column (9) are given the differences between the values in columns (6) and (8), indicating therefore the residual differences between the observed values of Δw, and the sum of those computed on the assumption of the independent variations in turn of the three elements which are known to be capable of altering the barometric weight of the air-column, viz. (1) top-pressure, (2) temperature, (3) humidity.

* This formula is adapted to the present case from the following one, given by Mr. Blanford in his paper before referred to, p. 610—

$$d_e = D \frac{B_1 + B_2 - \tfrac{3}{8} e \dfrac{1 + {\cdot}002036\,(T - 32)}{1 + {\cdot}002036\,(t - 32)}}{B_1 + B_2 - \tfrac{3}{8} E}$$

where B_1 B_2 are the initial pressures at the lower and higher stations respectively, T, t, E, e, the initial and final *mean* temperatures and vapour tensions respectively, and D d_e, the initial observed and final computed densities respectively. I have here used 460 instead of 461·2 as being a more convenient number to work with, the effect of such change upon the calculation being quite insignificant.

TABLE I.

Air Column between Darjiling and Goalpára, representing Air-Stratum of Vertical Thickness = 6,526 ft.

Months.	Δw observed in inches of mercury.	Δw_b or part of Δw due to change of pressure at Darjiling.	Δw corrected by preceding column.	Δt observed in degrees Fahr.	Δw_t or part of Δw calculated from Δt.	Difference between the values in Columns 3 and 5.	Δe observed in inches of mercury.	Δw_e or part of Δw due to Δe only.	Difference between the values in Columns 6 and 8.	$\Sigma\,\Delta w$ (comp.) or sum of values in columns (2) (5) and (8).
	In.	In.	In.	°	In.	In.	In.	In.	In.	In.
January to February ..	−·052	−·003	−·049	+4·0	−·048	−·001	+·015	−·001	·000	−·052
February to March	−·081	−·001	−·080	+6·1	−·071	−·009	+·051	−·004	−·005 E	−·076
March to April.	−·075	−·000	−·075	+4·8	−·055	−·020	+·129	−·010	−·010 E	−·065
April to May	−·049	−·006	−·043	+2·2	−·024	−·019	+·104	−·008	−·011 E	−·038
May to June..........	−·034	−·015	−·019	+2·2	−·024	+·005	+·110	−·009	+·014 D	−·048
June to July..........	−·013	−·001	−·012	+1·1	−·012	·000	+·026	−·002	+·002 D	−·015
July to August........	+·018	+·011	+·007	+0·2	−·002	+·009	·000	·000	+·009 E	+·009
August to September ..	+·027	+·015	+·012	−1·3	+·014	−·002	−·033	+·002	−·004 D	+·031
September to October..	+·056	+·015	+·041	−3·3	+·037	+·004	−·135	+·011	−·007 D	+·063
October to November ..	+·096	+·009	+·087	−7·3	+·084	+·003	−·144	+·011	−·008 D	+·104
November to December	+·071	−·006	+·077	−6·0	+·071	+·006	−·089	+·007	−·001 D	+·072
December to January..	+·036	−·017	+·053	−2·7	+·032	+·021	−·030	+·002	+·019 E	+·017
Column	1	2	3	4	5	6	7	8	9	10
Means of the Elements for January	6·228″ (w)	..	..	52°·0 (t)	..	..	0·309″ (e)	..	..	..

Reduction of w from January to July.

Observed.	Computed.	
In.		In.
0·304″	Part due to change of top-pressure from Column 2	0·026
	Part due to Δt from Column 5..............................	0·234″
	Part due to Δe from Column 8	0·034″
	Total	0·294″
	Difference between Observed and Sum of Computed Reductions	0·010″

The letter E, affixed to the values in this column, is employed to denote when the figures represent an excess of the observed over the sum of the computed values for Δw. The letter D, similarly placed, denotes a corresponding defect.

Finally in column (10) are given the sum of the computed values in columns (2), (5) and (8), for the purpose of direct comparison with (1).

The first prominent feature exhibited in the foregoing Table, and which I have found equally displayed in similar analyses I have made of 9 other air-columns in different parts of India, is the close inverse correspondence that exists between the variations in the monthly mean barometric weight and temperature of the air-column.

It is, moreover, evident that the figures in column (5), computed from the observed differences from month to month in the mean temperature of the air-column, represent by far the largest portion of the observed differences in its barometric weight.

Furthermore, it is plain that the effect of temperature on the variation in the barometric weight or density of the air-column is not merely felt in the aggregate between January and July (the case considered by Mr. Blanford), or between any two other epochs separated by a considerable interval, but that the variations introduced by the expansion and contraction of the air, under the influence of varying monthly mean temperature, apart from those introduced by changes in the proportion of its vapour constituent, bear an approximately constant ratio to the observed variations from month to month when the latter are corrected for change of top-pressure as in column (8).

The epochs of maximum variation, both negative and positive, occur in each from February to March and from October to November respectively; and though there is a slight anomaly between July and August, they both evidently reach their minimum variation about this time.

The only other factors we know anything about, or can physically estimate the statical influence of, viz. change of top-pressure and humidity, evidently play only a very subordinate part in producing the resultant variation; the variations due to each of these elements bearing a mean ratio throughout the year to that due to temperature (when they are supposed constant) of about 1 : 8.

It is plain, then, that if the air-column between Darjīling and Goalpára, as well as the others I have incidentally alluded to, fairly represent the condition of the *stratum* of air of the same vertical thickness over a large part of India, and the assumptions made as to the distribution of temperature and pressure in an oblique air-column (one of 100 miles in horizontal length in the present case) are tolerably correct;* by far the most important part of the variations from month to month in the barometric weight, or in other words, the density, of this stratum, are due to *temperature* alone.

This conclusion is identical with that derived by Mr. Blanford from a com-

* Mr. Blanford has shown that the errors arising from the assumptions are probably very small.

parison of the computed with the observed variations in the density of the same air-column, between January and July only.

I give a similar comparison of the variations between these months formed by taking the sums of the observed and of the computed values for Δw in the Table. The final difference between the former and the latter amounts to ·010 in., a result which substantially agrees with that obtained by Mr. Blanford.

A comparison of the annual range of variation in the barometric weight of the air-column between Goalpára and Darjíling, as well as of that between Roorkee and Simla, led the same writer to the conclusion that since the figures representing these ranges bear a proportion to those representing the annual ranges of barometric pressure at the lower stations, amounting to one-half in the case of the former, and two-thirds in that of the latter, they represented an equivalent proportion of the total annual variation of the barometric pressures at the latter stations.

It cannot, however, be maintained that they do so accurately, since the critical epochs are not the same for the barometric weight of the strata, and the pressures at their bases.

For, as I have already briefly stated, it was shown in 'Nature' (Vol. XX. No. 490), that while the barometric pressure at the base-station in the case of the air-columns between 5 pairs of stations in the plains, and on neighbouring elevations, in India, as usual reached its maximum in December, the barometric weight of the corresponding air-column invariably culminated in January, its epoch of minimum temperature, as well as usually that of the base-station.

A somewhat similar discrepancy is noticeable at the opposite epochs; the minimum monthly mean barometric weight of the air-column, generally coinciding more closely with its maximum monthly mean temperature, as given by the mean of the temperatures at the summit and base, than with the minimum pressure at the base, which often occurs a month or more later than the maximum temperature recorded at the base station.

The following synopsis of the critical epochs of pressure, temperature and barometric weight for a few stations, and the air-columns between them, will illustrate better than words, perhaps, the remarkable contrasts and harmonies they present. (See Table II.)

The barometric pressure at the level of the hill stations, moreover, unlike that on the plains, is affected with a *double* oscillation, having maxima usually both in November (the principal one) and March, and minima in January and June or July.

The oscillation of barometric pressure on the plains is thus made up of two oscillations, differing from each other both in character and phase; one taking place in the stratum of air of 7,000 feet or more in thickness immediately superjacent; the other in the remainder of the atmosphere above that level. Strictly speaking, therefore, the proportion in which the variation in the barometric weight of the lower stratum enters into the total barometric pressure on the plains, would be found by comparing the range of the former

TABLE II.

Pairs of Stations.	Barometric Pressure.		Temperature.		Stratum Between			
					Barometric Weight.		Temperature.	
	Max.	Min.	Min.	Max.	Max.	Min.	Min.	Max.
Goalpára .... Darjfling	Dec. Nov.	July July	Jan. Jan.	Aug. July	Jan.	July	Jan.	Aug.
Lucknow .... Ranikhet	Dec. Nov.	June July	Jan. Jan.	May June	Jan.	June	Jan.	June
Roorkee .... Chakráta	Dec. Nov.	June July	Jan. Jan.	June June	Jan.	June	Jan.	June
Lahore ...... Leh..........	Dec. Dec.†	July July*	Jan. Jan.	June July	Jan.	June	Jan.	July
Cuttack ...... Pachmárhi ..	Dec. Dec.	July July	Dec. Dec.	May May	Jan.	May	Dec.	May
Madras ...... Wellington ..	Dec. Dec.	June July	Jan. Dec.	June April	Jan.	May	Dec.	May
Bombay‡ .... Mahableshwar‡	Jan. Jan.	June July	Jan. Dec.	May April	Jan.	May	Jan.	May

* The winter minimum epoch of pressure at the Hill Stations has been excluded, because it has no direct connection with the strata below. In the case of Leh it is the principal minimum of the year.

† From another set of means for Leh the maximum appears in November, as in the case of most other Himalayan Stations.

‡ From means given in "The Meteorology of the Bombay Presidency," by Charles Chambers, F.R.S.

with the sum of the range of the latter, and that of the barometric pressure at the top-station.

The following Table gives the annual ranges of the barometric pressures at some of the principal hill-stations and their corresponding subjacent plain-stations, together with those of the barometric weights of the intervening air-columns :—

TABLE III.

Station on the Plains.	Elevation above Sea Level.	Range of Pressure Oscillation.	Station on the Hills.	Elevation above Sea Level.	Range of Pressure Oscillation.	Air Column between Vertical Thickness.	Range of Barometric Weight.	Sum of Ranges of Pressure at Upper and Lower Station.
	ft.	In.		ft.	In.	ft.	In.	In.
Goalpára	386	0·448	Darjfling	6,912	0·205	6,526	0·304	0·509
Cuttack	80	·476	Pachmárhi	3,504	·395	3,424	·154	·549
Bareilly	568	·562	Ranikhet	6,069	·245	5,501	·338	·583
Roorkee	887	·534	Chakráta	7,052	·167	6,165	·388	·555
Lahore	732	·622	Leh	11,538	·123	10,806	·610	·738
Madras	22	·221	Wellington	6,200	·107	6,178	·141	·248

It appears from the preceding table, that throughout India about $\frac{3}{5}$ths of the entire variation of barometric pressure on the plains, is due to an altera-

tion of the density of the stratum which lies between 500 and 7,000 feet, and apparently as much as $\frac{5}{9}$ths to that between 700 and 11,500 feet.

Mr. Blanford, in 'The Winds of Northern India' (p. 609), from an examination of the 8 air-columns between

Goalpára and Shillong,	vertical thickness	4,406	feet,
" Darjíling	"	6,555*	"
Roorkee and Simla	"	7,184	"

and comparing the ranges of the barometric weights of these strata directly with those of the barometric pressure at their bases, concluded "that of the whole annual oscillation of the atmospheric pressure over the Gangétic plain . . . . nearly one half is due to an alteration of the density of that stratum of the atmosphere which lies between 400 and 5,000 feet, more than two-thirds to that of the stratum between 400 and 7,000 feet (Goàlpara and Darjiling), and nearly two-thirds to that between 800 and 7,000 feet in the north-western provinces (Roorkee and Simla)," proportions rather greater than those given by my method of comparison. It follows, however, that in either case it may be safely concluded *that the variations in the density of the stratum of air between the plains and the more lofty hill-stations of India, from month to month, compose the major part of the nearly similar variations in barometric pressure on the plains, and that these variations are mainly due to those of temperature.*†

Whether *secular* variations in the barometric pressure on the plains can be ascribed in like manner, chiefly to corresponding *secular* variations in the density of the stratum *below* the level of the hill-stations, is another question altogether, though it can evidently only be properly studied with due reference to the foregoing conclusion.

From an interesting article by Mr. Blanford, in a recent number of 'Nature' (March 18), on "the Barometric See-saw between Russia and India in the sun-spot cycle," it would appear that the excessive pressure generally observable on the plains in years of minimum sun-spot, was in one case actually traced to be, and is with some probability always mainly due to a more than ordinary pressure of the atmospheric strata above 7,000 feet. Such a fact appears mysteriously opposed to the evidence hitherto adduced respecting the main source of the annual variation of pressure, but the latter places it at once within our power to explain part of the mystery, viz. why the excess should be more marked at the hills than on the plains. For in such years the temperature of the lower stratum in India is above the average,‡ and, therefore, its density should be less than usual. The excess of pressure at the higher station would thus be counteracted to some extent at the lower by the comparatively diminished density of the air between.

* The altitude of the Observing Station at Darjíling was there taken to be 6,941 ft., instead of, as it is now given in the 'Vade Mecum' 6,912 ft.

† Mr. Blanford arrives at a somewhat similar conclusion from his analysis.

‡ *Vide* "Variations of the Rainfall in Northern India," by S. A. Hill, 'Indian Meteorological Memoirs,' No. VII., p. 193.

The problem in this case is evidently reduced to finding out what causes an excess of pressure at the upper stations in such years.*

Reverting for a moment to the Table, it will be seen that the increase in the pressure at Darjíling is confined to the period between July and November, in other words, the rainy season, and that this increase of pressure sets in before any marked decrement of temperature is recorded at the upper station, or even, in the case of Darjíling and Goalpára, before the temperature of the stratum below has ceased rising.

This anomaly with respect to temperature, would probably disappear to a great extent, if we could estimate the influence of the copious condensation of vapour, which takes place during the first part of this period at the level of the hill-station, in reducing its temperature decrement.

The rapid decline of pressure at the higher stations from November to January is ascribed by Mr. Blanford to the setting in at their level of the warm, moist anti-monsoon vapour current; while the subsequent rise of pressure in March or April, which is not so noticeable in the case of Darjíling as in most of the other hill-stations, is provisionally attributed to the great expansion of the lower atmosphere in these months, by which a larger portion than usual is temporarily lifted above their level.

There appear to be so far, no serious objections to either of these explanations, but for their final acceptance, as well as the solution of the entire problem of the annual variation of barometric pressure, we must plainly await the result of investigations into the conditions of the atmosphere at greater heights than have hitherto been rendered available.

Prof. Hill, of Allahabad, thinks the whole question of the double oscillation of pressure at the higher levels may be accounted for, without bringing in any hypothetical saturated anti-monsoon current, and considers the entire phenomenon to be due to the difference in the facility with which the expanded air flows out from above, and the contracted air from below, a given vertical air-column at different times of the year, as compared with that with which it enters the other ends respectively; a relative excess of outflow at the upper end causing the minimum in June, and at the lower end that in January, the opposite epochs being produced in like manner by corresponding relative defects of outflow at either end.

It is plain that something like this must take place, as were the expanded air to remain where it is, the total pressure at the surface of the earth would remain sensibly constant throughout the year, while at elevated stations it would be highest in Midsummer. The action, however, probably differs in character at different seasons of the year, partaking more of the nature of simple expansion in the dry hot months, upward convection currents during the rains, and downward convection currents during the cold weather.

* A part of the excess might be due to the greater mass of air thrown above the higher station in hot years, as suggested by Dr. Hann (Zeitschrift für Meteorologie Band XV. Mai Heft); but, as Mr. Blanford shows in the same publication (Oct. Heft) this would only be the case as long as there was no outflow above to regions where the air was not similarly uplifted.

Passing on to column (8), it is evident that while humidity accounts for but a small part of the entire variation, we cannot by any means afford to entirely disregard it. In the interval from April to May, and again from September to October, it accounts for nearly one-fourth of the whole variation. In the cold-weather months, on the other hand, its influence is scarcely perceptible.

A comparison of the figures in this column with those in (5) shows that the variation from March to April due to humidity alone, bears to that due to temperature when the pressure is considered constant, almost precisely the ratio the two *should* bear to one another in a *freely expanding* atmosphere, if they were both due to equal amounts of heat received. This ratio is exactly 1 : 5 . 44.*

At this time, and probably again in October, the condition of the lower atmospheric strata is thus more probably the result of local actions set up by the direct solar rays than at any other time of the year.

The effect of the variations in the monthly mean baric gradient between places on the same level in India in vitiating the assumption that the barometric weight of an oblique air-column, such as that which has been discussed, equivalently represents the barometric weight of a vertical air-column of the same altitude, comes under the category of those errors of assumption which were found by Mr. Blanford to be relatively insignificant. The aggregate error between January and July does not amount, on Mr. Blanford's showing, to more than ·006 in. in the observed value of w. Application of the necessary correction, would slightly reduce the excess of the observed over the calculated variations of w.

I cannot conclude this Paper without drawing attention to a letter from Prof. Hill to 'Nature,' Vol. XXI., p. 513, on "the Annual Variation of the Barometer in India," in which, by the employment of different data and methods to those used in the present Paper, he substantially supports the views here advocated, regarding the predominating influence of temperature on the lower atmospheric strata, in effecting the main portion of the annual variation of monthly mean pressure.

I am of course well aware that in this brief analysis of an Indian air-column, the statical side of the question has alone been considered, but it is obvious that if by such a treatment of the problem, so large a proportion of the observed variation is accounted for, dynamics must necessarily enter but sparingly into the result.

Postscript.

While engaged in correcting the proof-sheets of the preceding paper, I have received a letter from Prof. Hill, which explains more clearly than does his letter to 'Nature,' already referred to, his idea of the causes which produce the double annual oscillation of barometric pressure at the level of the

* *Vide* Blanford's 'Vade Mecum,' pp. 18-19, and 21.

hill-stations in India. The anti-monsoon upper-current he considers to be, not the *cause*, but the *effect* of the winter depression in the higher strata; the entire variation of pressure at the level of the hill-stations being a differential one, due to variations in the supply of air to or from below, in conjunction with corresponding variations in the efflux and influx of air above.

As the rate at which the air is lifted or flows up from below, varies directly with the rate at which the temperature rises, and *vice versâ*, it is pretty clear, even without the employment of mathematical methods, that the pressure will reach a maximum when the temperature of the air in the lower strata is rising or falling most rapidly, and a minimum when the variation of temperature is least, *i.e.* at the hottest and coldest times of the year.

The mathematics of the action are thus given by Prof. Hill:—

"We may suppose the rate at which the air flows away from above Leh to be nearly proportional to the excess of pressure at that point above a certain standard or zero value. The rate of variation of pressure from this cause will be—

$$-\frac{dp}{dt} = k\,\Delta p \quad . \; . \; . \; . \; . \quad (1)$$

where Δp is an integral of the form $\int_0^t \frac{dp}{dt}\,dt$ which we need not attempt to determine.

The rate of increase of pressure by the ascent of air from below will be proportional to the rate of rise of temperature or—

$$+\frac{dp}{dt} = a\,\frac{d\Theta}{dt} \quad . \; . \; . \; . \quad (2)$$

Combining these two partial equations, we get—

$$\frac{dp}{dt} = a\,\frac{d\Theta}{dt} - k\,\Delta p \quad . \; . \; . \quad (3)$$

In the case of a cooling and sinking atmosphere with inflowing currents, this will become—

$$\frac{dp}{dt} = k\,\Delta p - a\,\frac{d\Theta}{dt} \quad . \; . \; . \quad (4)$$

For the maxima and minima we have in either case—

$$\Delta p = \frac{a}{k}\,\frac{d\Theta}{dt} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \quad (5)$$

therefore Δp is a maximum, when $\frac{d\Theta}{dt}$ has its maximum value, that is, when when the temperature is rising or falling most rapidly," etc.

Prof. Hill admits that the assumption involved in equation (1) is doubtless not strictly true. It nevertheless agrees fairly well with the results of observation.

For example, from the following data:—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
sure at Leh in ches	In. 19·604	In. ·578	In. ·640	In. ·649	In. ·668	In. ·650	In. ·616	In. ·640	In. ·692	In. ·722	In. ·742	In. ·701
n Temperature in grees Fahr. at orkee, Chakráta d Leh	38°·6	42°·3	50°·4	60°·4	66°·4	70°·7	70°·0	68°·9	65°·2	57°·3	47°·3	42°·5

he deduces the following approximate dates for the critical epochs of Temperature and Pressure:—

		Pressure.	
Temperature Min....	January 16th	Minimum Winter	February 8th.
Most rapid rise of Temperature ...	April 26th	Spring Maximum	May 16th.
Temperature Max. ...	June 26th	Summer Minimum	July 23rd.
Most rapid fall of Temperature ...	October 25th	Autumn Maximum	Nov. 10th.

What, according to the preceding theory, should be the effect, follows the cause at a nearly constant interval, the intervals being 23, 20, 27 and 16 days respectively.

Prof. Hill's results for the upper atmospheric strata form a necessary complement, and therefore a fit supplement to what I have shown to obtain for the lower strata, especially as regards the predominating influence of temperature in causing barometric variations of annual period.

The entire annual variation of monthly mean pressure has thus been analysed into two components: one, a variation of density, mainly due to temperature in the lower strata; the other, a variation of flow alternately in the upper and lower strata, of whose exact amount and character we are still ignorant.

Though the conclusions so far, apply strictly only to India, it is only reasonable to suppose that, in a modified form, they apply universally, and may thus be found useful in educing the causes which contribute to produce the more irregular variations of monthly mean pressure in other parts of the world.—*October* 1880.

DISCUSSION.

Mr. LAUGHTON had no intention of attempting to discuss the paper off-hand: it was one that required calm and deliberate study. Without venturing an opinion on the deductions put forward, he would only say that according to the tabulated observations, they appeared to have a *prima facie* case in their favour. He wished, however, to ask in what sense Professor Archibald used the term "barometric weight,"—was it to be understood as veiling a certain "statical" theory? Was it identical with, or different from "barometric pressure"? In some sentences both terms were used; and the distinction between them—if any was meant—was not quite clear.

Mr. C. HARDING said that the Meteorological Office had worked the monthly pressures and temperatures from sea observations for the Atlantic Equatorial District, and it seemed to him that the results did not show much relation existing

between pressure and temperature, but the annual curves of temperature and vapour tension might be said to exactly coincide. He thought it advisable to consider the effect of the direction of the wind on the results arrived at in the present paper, since the stations were a considerable distance apart.

Prof. ARCHIBALD, in reply, said that he had used the term "barometric weight" in the same sense as Mr. Blanford had employed it in his "*Vade Mecum*," as proportionately representing the mean density of a definite atmospheric stratum.

Meteorology of Mozufferpore, Tirhoot, for the year 1879. By CHARLES N. PEARSON, F.M.S.

[Read May 19th, 1880.]

THE year 1879 was in many respects an extraordinary one. It was especially remarkable for the drought that, with the exception of a few light showers in February and May, prevailed till June 17th. It was further marked by unusually heavy and persistent rains, giving a total of 65 inches between June 17th and October 16th.

The month of *January* was dry throughout, and remarkable for the absence of the rains, which usually fall in that month. Strong W winds prevailed in the latter half of the month, especially on the 31st, when it blew with the force of a dust-storm; white frost occurred in the nights from the 23rd to the 26th. *February* was more seasonable, with showers on the 10th and 15th, which prevented the rubbi crops from being a failure.

March and *April* were extremely dry and hot, not a drop of rain fell in either month. This is very unusual, and has not occurred before within my recollection. Besides the drought, these months were both characterised by excessive heat and dry hot winds. In April the mean maximum temperature was 100°·4, and the maximum reached 100° and upwards on 17 days, and on the remaining days ranged between 94° and 99°; the differences between the day and night temperatures were also very large, and the solar radiation unusually great. These influences combined, so long continued, caused the grass and pastures to be completely parched up.

May was also extremely dry, and a month of intense heat. The mean of all the maxima was 101°·4, and the maximum temperature exceeded 100° on 20 days. There was an almost total absence of the usual north-westers, which cool the air occasionally at this season, The only showers fell on the 1st and 27th; but such was the dry, heated state of the ground, that there was no appearance of rain having fallen an hour after it had ceased; the actual highest temperature in the shade was 108° on the 12th and 17th, but it was within a degree or so of this on many days. The lechee and mangoe crops were both almost total failures. The former, which I have never known to fail before, is the usual fruit crop of the season, but this year the heat and drought shrivelled the fruit upon the trees, and caused it to fall prematurely. The last few days of May were rather cloudy, with strong E winds and an unsettled appearance, but still without rain.

This state of things continued during the first fortnight of *June*. From the 5th to the 13th the heat was intense, reaching 107° in the shade on the 11th. During this long period of drought between January 1st and June 17th but 1·86 in. of rain fell. As the previous autumn had also been very dry, the usual October rains having failed, the failure of pasturage and want of water was very severely felt. On June 17th a great change occurred. Several severe thunderstorms with torrents of rain ushered in the rainy season. No less than 13 inches of rain fell on the 17th and 18th. It is remarkable that this very heavy rain was local. No rain fell at Hajipore, 34 miles south of this, till the 21st. Here, after the heavy fall, constant showers occurred till the end of the month. The total fall for June was 17·14 ins.

July was remarkable for its constant and heavy rains. Not a day passed from the 1st to the 21st without rain. From the 22nd to the end of the month there was a partial break, but the heat was most oppressive, and the atmosphere like a steam-bath. There was scarcely any wind, and the country was extensively flooded. The total rainfall in July was 17·62 ins.

During *August* E breezes prevailed almost constantly, and the weather was much pleasanter; very constant showers fell, but the aggregate rainfall during the month was only 5·39 ins. *September* was a hot oppressive month; very heavy rain between the 6th and 12th. On the 12th no less than 6·85 ins. fell. At Purneah the very extraordinary fall of 35 inches occurred in one day, the 13th. The latter part of September was generally fine and hot, but with thunder showers at times; very favourable for the rice crops. The total rainfall was 14·08 ins.

October was a most favourable month for the crops; 9·40 ins. of rain fell between the 1st and 16th. On the 9th upwards of 6 inches fell. After the 16th fine and unusually cool weather set in, and lasted till the end of the year.

The rice harvest was the finest known for years, and the prospects are generally favourable. The total rainfall during 1879 amounted to 65·49 ins.; nearly 30 inches more than in 1878, and upwards of 10 inches above the average. It was the largest rainfall recorded here since 1871. It was, however, more unevenly distributed, nearly the whole of it having fallen between June 17th and October 16th—a period of just four months.

The great drought at the beginning of the year was probably one of the causes of the terrible epidemic of cholera that prevailed here in May and June. We are unhappily without statistics, and the authorities tried to prevent a knowledge of the full violence of the epidemic from getting abroad; but for nearly a month it raged like a pestilence, and I heard from Indigo planters, well qualified to know the facts, that upwards of 60,000 persons died of it in the country around. In Mozufferpore itself the deaths were roughly estimated at 10,000. It travelled to us from the E, and continued its course to the NW, where it also raged terribly. It was arrested eventually by the heavy rains, but was succeeded by an epidemic of fever, which, though not so fatal, was very wearing and depressing. Dysentery also was unusually

prevalent during the rains; the year was altogether a most unhealthy one, though the heavy rains and floods may probably be productive of great future benefit.

Ozone in Nature: Its Relations, Sources, and Influences, &c. From Fifteen Years' Observations Ashore and Afloat, under all Conditions of Climate By JOHN MULVANY, M.D., R.N.

[Read June 16th, 1880.]

OZONE, since its discovery by Schönbein, has been to the scientific world a subject of unceasing study and observation; by medical men especially it has been regarded with the deepest interest, for experiments have shown that artificially-prepared ozone is endowed with great energy of action, and capable, by its physical attributes and chemical affinities, of playing a very important part in the chemico-vital processes of the system and in the purification of the atmosphere. It liberates oxygen, checks putrefaction, and renders the products of retrograde metamorphosis more facile of elimination. As it is rarely dissociated from electrical and other subtle agencies which may be capable of disturbing the functional harmony of the system and masking its effects, these can only be realised by accumulating such an abundance of data, collected under the most varied conditions of climate and topography, &c., as will admit of the differentiation of the action of ozone *par voie d'exclusion*. For this purpose it is easy to understand that exceptional advantages are enjoyed by a Naval Surgeon.

In the observations from which this report is epitomised are embraced the varied conditions of climate met with between the Doggerbank on the north and Madagascar on the south, from Canada to the Falkland Islands, and from 96° of longitude West to the same number of degrees East, as well as the modifications which ozone exhibits under changes of temperature, humidity, pressure, geographical position, configuration, soil, contiguity to a desert, a jungle, or a marsh, as well as the corresponding sanitary conditions, of the crews on board ship and the natives on shore.

As the investigation of its effects may be advantageously preluded by that of its relations, I will proceed to the consideration of the latter, commencing with *Temperature*. From experiments in the laboratory, where a high temperature breaks up the peculiar grouping of the molecules of oxygen which constitute ozone, and restores them to their more bulky and less active state, it has been supposed that a much-heated condition of the atmosphere is inimical to ozonisation; and hence, probably, it has come to be axiomatically formulated that the curve of the ozone follows a course inverse to that of the temperature. Strictly speaking, this rule holds good where a high temperature, with a minimum humidity, obtains; but this is too seldom witnessed in nature to constitute a rule, so narrow is its applicability that it might rather be classed outside the laboratory as an exception. For as the

atmosphere becomes rarefied by heat, its capacity for taking up and holding water in a state of vapour is correspondingly increased; and, consequently, a high temperature, except under peculiarities of locality to be alluded to hereafter, is always associated with a high humidity, which is favourable to ozone. But regarding temperature alone from the extreme of cold to that of heat, it will be seen by a glance at the following table that the temperature of the atmosphere *per se* bears no relation to the ozonic state.

Date.	Place.	Temperature in Shade.			Ozone.
		Min.	Max.	Mean.	Mean.
		°	°	°	°
January 1867 ..	Lake Erie	—14	32	9	2·5
„ 1868 ..	„	—16	27	5·5	2·5
April 1868 ..	„	31	52	41·5	3
March 1870 ..	Haslar Hospital	26	61	43·5	2
August 1872 ..	Mozambique ..	70	90	80	1·3
November 1873 ..	Trincomalee ..	75	86	80·5	10
May 1872 ..	S.E. Africa	78	88	83	9·5
September 1871 ..	Persian Gulf....	83	104	93·5	9·5

Humidity.—When a high humidity accompanies a high temperature, the rule—with many exceptions, however—is that ozone is also high; and with a similar temperature and a low humidity, ozone is scanty. This is illustrated by the following figures:—

Date.	Place.	Temperature.		Humidity.		Ozone.
		Min.	Max.	Saturation.	Vapour Tension.	Mean.
		°	°	o/o	In.	
October 1865 ..	Santa Marta......	78	85	77	0·723	5
August 1871 ..	Persian Gulf	87	114	79	1·223	6
July 1873 ..	Zanzibar	70	84	78	0·864	6
May 1873 ..	Muscat, hot winds	94	99	28	0·514	a trace
September 1872 ..	Madagascar	72	97	51	0·570	2
January 1877 ..	Falkland Islands ..	33	61	74	..	10

Than this relation of ozone to heat and humidity, nothing is more calculated to impress us with the benignity and prescience of the design which causes an augmentation of ozone, when for the maintenance of a pure atmosphere it is most wanted—that is, under the conditions of heat and humidity, in which organic compounds are most unstable, and putrefy with the greatest rapidity. The association of ozone with vapour in a high state

of tension, though not definite in its relation, is, nevertheless, so constant that whatever tends to elevate the latter will have a similar effect on the former. This is well exemplified in the case of *Winds*. The hot dry winds that sweep over the arid rocks of Beloochistan or the thirsty sands of Arabia rarely contain more than a trace of ozone when they reach the seaboard. In the Mozambique Channel, which the south-east trades reach after having their moisture wrung out of them, and their course diverted by the high central plateau of Madagascar, ozone is very scanty indeed. At Trincomalee, in Ceylon, during the south-west monsoons which reach it after being filtered through the jungle, a great paucity of ozone is met with in the lower atmospheric strata; but, on the contrary, wherever the breezes reach that sweep over a large extent of sea, ozone and humidity are usually abundant; hence it appears to be through the nature of the surface over which they blow that winds influence the ozonic condition, rather than by their force or direction.

Area.—The surface area over which the winds pass, if homogeneous, tends greatly to augment or diminish the ozone; water producing the former effect and land the latter, especially if sparsely covered with vegetation. The difference between the ozone on the west and east coasts of Mahé, in the Seychelles, being one to two shades less on the leeward side. In passing through the Bay of Bengal, January, 1874, with the north-east monsoon blowing, I got at Trincomalee, the port of departure, the maximum shade of colouration; at Port Blair, in the Andaman Islands, it only amounted to 2°; and at the mouth of the Irrawaddy it barely reached 1°.

Clouds are favourable to ozone. In the Indian Ocean, where, during monsoon weather, heavy, murky, piled clouds are often met with, the atmosphere is, as a rule, strongly ozonised; whereas, when the sky has been bright, blue, and cloudless for a week or ten days, it usually averages 1°·5 to 2°.

Atmospheric pressure, humidity apart, does not appear to exercise any influence whatever over the ozonic condition; but taking 29·9 ins. for the intra-tropical, and 30·0 ins. for the extra-tropical standard, the greatest abundance coincides with barometric readings below these.

Rain sensibly augments the ozonic state. If there has not been a trace of colouring for several days, a single shower is often observed to effect an immediate colouration. I once observed this under circumstances entirely unique. On the passage of H.M.S. 'Magpie' to Seychelles, in 1873, there was an abundance of ozone from a few days' sail off the Arabian coast to within a short distance of the Equator. I did not obtain the faintest trace of it during the 18th, 19th, and 20th of June, although the sky was cloudy, the air hot and humid, and the wind high and squally; but during the night of the 20th it rained heavily in showers, and next morning the test slip was coloured to the utmost.

Relative abundance of Ozone in N and S Latitudes.—My data are too scanty to draw conclusions from; but I found that during 250 days south of the Equator the ozone averaged 3°·5, and during 450 days north of it in the

a it averaged 6°·5. This would point to a greater abundance in the n sea-atmospheres. On the other hand, during a long sojourn in kland Islands, close to Cape Horn, I rarely found the ozone less than imum.

Squalls.—A squall without rain produces a very slight increase of out the increase resulting from a rain squall is very decided. *A thin nizzle* of a day's duration will not show more ozone than a strong f two hours. This led me to believe that the *phosphorescence of the seas* might be a source of ozone, and that the thin mizzle might i its effects from the sharp squall by the greater momentum of the ps in the latter, whereby they penetrate the sub-surface waters and the myriads of noctilucæ which have their habitat there, and thus iem to light up their tiny lamps, and in so doing generate ozone; ailed to corroborate this by experiment, and subsequently found o believe that rain simply acts as a vehicle, and that the difference in dependent on altitude rather than on momentum.

ide.—I have had frequent opportunities of observing that ozone may the upper atmosphere in greater abundance than in the lower. I ly obtained a high degree of coloration at the masthead when the air ipper deck hardly gave a trace. At Trincomalee, in 1878, during the isoon, the greatest amount of ozone was always obtainable at the flagstaff ort, 175 feet high; the next at the maintop of my ship; then on nd the smallest in the village. This was accounted for by the wind through the jungle before reaching the deck. The height of the st reached a stratum which had only been partially affected by the as the flagstaff towered over the tops of the tallest trees. This effect urious that it may be interesting to represent it in a tabular form. t of experiments will suffice.)

Exposure.	Ozone obtained at		
	The Flagstaff, 175 ft. high.	The Main Top H.M.S. 'Magpie,' 120 ft.	On the Deck.
ı 9.30 a.m. to 9.30 p.m. 6th October, 1873....	9	7	2
9.30 p.m. 6th Oct. to 9.30 a.m. 7th Oct.	5	5	2
	14	12	4

this it may be inferred that ozone does not diffuse readily from the) the lower strata.

oration.—From the close relation that exists between humidity and evaporation would seem to be one of its sources; but, although it

contributes towards its genesis '*de longue main*,' it is not produced by the act of evaporation.

Genesis of Ozone.—But though not a direct factor of ozone, evaporation appears essential to its formation; for, dormant in the vast quantities of vapour which ascend from the surface of the tropical seas at or beyond a temperature of 85°, it throws into the upper strata of the atmosphere prodigious quantities of force in the form of latent heat. And as electricity is strongly developed at the surface of the earth by the precipitation of vapour on a clear summer's evening, when a cloudless sky permits free radiation, it must also be similarly generated in the upper regions of the atmosphere by radiation and condensation, and it is easy to conceive that the electric tension so augments that the insulating medium of Quetelet—diminished in resisting power by the hot humid air surging upwards from the inter-tropical seas—becomes at times unable to keep the opposed electricities apart, and in the act of uniting, the paramagnetic oxygen gets acted upon and condensed into ozone. If this supposition be correct, the action of rain and other conditions favourable to ozone is easily understood. Rain would simply act the part of a vehicle, and bring us ozone from the upper regions; and the difference between a smart shower and a drizzle would be occasioned by the former coming from a greater height, than the latter, as attested by the greater velocity and momentum it acquires in falling, in virtue of the accelerating force of gravitation. It is probably owing to the absence of this vehicle that no appreciable increase of ozone is occasioned by the noiseless sheet lightning so common in autumn and in the tropics. It cannot be doubted that sheet lightning is identical in nature with the terrific coruscations which, accompanied by thunder and rain, render the formation of ozone appreciable by the olfactories; but there is every reason to believe that the former occurs at a much greater altitude—at such a distance, in fact, that its accompanying sound cannot reach us.

OZONE: ITS RELATION TO DISEASE.

Malignant Cholera.—Scanty ozone, or its total absence, was supposed by Stiemer and others to be the *primum mobile* of malignant cholera; and Armand Jobert looked for the effective cause of the same terrible malady in a similar condition of ozone, combined with increase of temperature, great humidity, and stagnation of the atmosphere. During the cholera epidemic which swept the East in 1871, and affected the crew of H.M.S. 'Magpie,' the ozonic condition presented no peculiarity, either in point of paucity or of abundance; and it is not a little remarkable that when the heat reached its maximum, and brought in its train great humidity and aerial stagnation, so far as an absence of winds constitute it, the cholera entirely ceased, but reappeared as soon as the great heats were over, and evening atmospheric circulation became brisk. The following table will show the leading features of the two cholera periods, and the intervening healthy interval, in the Persian Gulf in 1871:—

1st Cholera Period.	Healthy Interval.	2nd Cholera Period.
Wind Force—0—2 to 6—*Shamal*	None	Direction. Vbl. Force 2 to 6
Temperature 75° to 93°	89° — 104° *shade*.	80° — 94°
Vapour Tension 0·654 in.	1·106 in.	1·015 in.
Saturation 50 o/o	84 o/o............	70 o/o
Ozone 4 to 9	2 to 6	2 to 6
Period 1 July to 20 July........	20 July to 28 Aug.	28 August to 1 October

In both these cholera periods it would be impossible to suppose that ozone was in any way connected with the origin or prevalence of the disease, and to me it is quite clear that its temporary cessation was occasioned by the intense heat.

Consumption.—This disease has been ascribed by some to a deficiency, and by others to the opposite extreme, of ozone. Among those who held, or hold, the latter, was the illustrious chemist to whose researches we are indebted for the discovery of ozone. I fear he, like many others, drew his conclusions from observations in the laboratory, rather than in the world at large. The disease is more frequently met with under circumstances unfavourable to ozone—viz., where overcrowding occurs; and the atmosphere not only gets used up, but is polluted by exhalations from the skin and lungs. To ascribe the disease to ozone would, under circumstances such as these, be manifestly illogical. In Nassau, New Providence, the sanitarium of the West Indies for consumptives, the disease commits the most fearful ravages amongst the negroes, who sleep in close, small, windowless huts, stretched out *ventre à terre* on the floor; but spares the whites, whose sleeping apartments and houses are large and well ventilated. Similarly in Seychelles, the disease is seldom met with, except among the blacks, who much resemble their brethren of the west in their domestic arrangements. Amongst the Sakalavas—Arabs and Negroes on the West Coast of Madagascar—where I never found ozone above two shades in the twenty-four hours, I did not observe a single case of pulmonary disease. The Falkland Islanders enjoy a similar immunity from phthisis, although ozone is probably more abundant there than in any other part of the world; in fact, as far as my observations enable me to form an opinion, I believe that ozone neither tends, in excess or deficiency, to beget consumption.

Excess of Ozone.—In the Indian Ocean and the Falkland Islands the ozone is high; in the former frequently, and in the latter very frequently, the ozone slips reached their maximum coloration in less than twenty-four hours. The diseases which I found to coincide most frequently with this condition were fevers, functional disease of the heart, and dysentery, in the Indian station; and in the Falkland Islands, asthma.

Functional disease of the heart very often coincides with a high ozonic condition. A great many cases of it occurred on board my ship in 1871, 1872, and 1873; but although ozone, when breathed in excess by animals under experiment, may be said to produce this affection, I do not think it

has ever been found in nature of such potency as to exert a similar effect on man.

SUMMARY.—The meteorological elements with which ozone is most intimately associated are such as occasion high vapour tension and a high degree of saturation: therefore, it is promoted by wind passing over a large aqueous expanse, and by heat producing rapid evaporation. Hence heat, if humid, is no bar to atmospheric ozonisation; but no definite relation exists in the atmosphere between heat *per se* and ozone. Its relation to humidity is more definite and direct, but subject to many exceptions. In consequence of this relation, it most abounds where its chemical qualities render it most useful. It appears to be formed in the upper strata, and to be carried downwards by rain drops, whose office is vehicular. The spherules of water which constitute clouds, and have their origin in radiation and condensation, have a similar office. Ozone does not appear to diffuse readily downwards, so that when the lower strata are robbed of ozone by jungle, &c., a considerable difference in the ozonic condition close to, and at 170 feet above, the surface may exist.

I am of opinion that no disease can be clearly traced to ozone as met with in the atmosphere.

DISCUSSION.

Dr. TRIPE said that some years ago, he and Dr. Burge of Fulham made some observations respecting the amount of ozone contained in the atmosphere, and they found that when the wind passed over London from the west, the amount of ozone was greatest at Fulham, and when the wind was easterly the ozone was greatest at Hackney. He thought that ozone was sometimes mistaken for something else, as on one occasion when fireworks were being let off about a mile from his residence, the test paper was discoloured to a greater extent than he had ever noticed before. He was of opinion that ozone was beneficial to health, and was most prevalent at mountainous places and at the sea-side.

Dr. WILLIAMS had noticed that the author had made no reference whatever to Schönbein's statement that ozone produced a form of influenza. He believed Schönbein to be correct, as he and others had noticed the same phenomena following the presence of ozone in large quantity in the atmosphere.

Mr. WHIPPLE thought that a great deal of the discoloration of the test papers might possibly be due to nitric acid in the air formed by atmospheric electricity. Ozone indications would also vary with humidity, from the fact that chemical action was always more energetic when a test paper acted upon was damp than when it was dry. He would like to know whether it was possible to get much discoloration from ozone with a perfectly dry paper.

The PRESIDENT (Mr. Symons) said that from observations made at a number of stations all round London, it was always found that the stations nearest the point from which the wind was blowing registered more ozone than the others. He thought that the greater velocity of the wind at the top of the flagstaff than at its base would explain the greater discoloration of the papers placed there.

The Average Height of the Barometer in London. By HENRY STORKS EATON, M.A., F.M.S.

[Read June 16th, 1880.]

THE present Paper is submitted as a continuation of one on the same subject read before the Society on the 21st of January, 1863.* It has been prepared with a view of applying to the tables of the average height of the barometer therein contained, corrections for diurnal range of atmospheric pressure, now rendered possible by the publication of the reduction of the photographic records of the barometer at the Royal Observatory, Greenwich. The opportunity has also been taken to revise the tables formerly given, to introduce some slight modifications in the reductions, and to continue them to the end of the year 1879, so as (disregarding the results for the year 1781) to embrace a period of 100 years.

A general description of the instruments is given in the paper of 1863. It will be sufficient, on the present occasion, to refer briefly to the chief points of interest in connection with them, and to mention the changes introduced in the final reductions of the observations.

Four barometers were used, the correction for capillarity being as under:—

Barometer.	Period of Observation.	Internal diameter of tube.	Mercury.	
			Unboiled.	Boiled.
		In.	In.	In.
1. Cavendish	1774—1822	0·250	+0·040	
2. Daniell	1823—1836	0·530	+0·006	
3. Royal Society Flint Glass	1837—1840	0·594		+0·002
4. Royal Observatory Standard	1841—1879	0·565		+0·003

The same corrections as formerly have been retained for Nos. 1 and 2, since although the mercury of No. 2 was boiled in the tube, this had, in the year 1827, attained the condition of an unboiled tube.† For No. 3 the addition made by Baily has been reduced from 0·004 in. to 0·002 in., and for the Greenwich standard barometer the readings have been increased by 0·003 in., the correction for capillarity not having hitherto been applied. With respect to the addition of 0·030 in. for index error, referred to in the Paper of 1863 as applied to all the observations of barometer No. 1 from the year 1787, on the assumption that Daniell's barometer, No. 2, was correct when the comparison was made, the conditions of the case will probably be better satisfied by assuming a gradual and equable deterioration of the vacuum of the older instrument; the following corrections have therefore been substituted for index error in this instrument:—

* Proceedings of the British Meteorological Society, Vol. I., p. 273.

† Meteorological Essays and Observations. By J. Frederic Daniell, 1827, p. 579.

Additive corrections for index error applied to the readings of the Royal Society Barometer, No. 1, Cavendish.

Year.	In.	Year.	In.	Year.	In.	Year.	In.	Year.	In.
1774	0·000	1788	0·009	1797	0·014	1806	0·019	1815	0·025
1775	·001	1789	·009	1798	·015	1807	·020	1816	·025
1776	·001	1790	·010	1799	·015	1808	·021	1817	·026
1777	·002	1791	·010	1800	·016	1809	·021	1818	·027
1778	·003	1792	·011	1801	·016	1810	·022	1819	·027
1779	·003	1793	·012	1802	·017	1811	·022	1820	·028
1780	·004	1794	·012	1803	·018	1812	·023	1821	·028
1781	·004	1795	·013	1804	·018	1813	·024	1822	·029
1787	0·008	1796	0·013	1805	0·019	1814	0·024	1823	0·030

The propriety of adopting this course is supported by the behaviour of the Royal Society barometer, No. 8. This, it may be remembered by the Fellows, is a twin instrument, having, besides the flint glass tube 0·594 inch in diameter, a second tube of crown glass 0·658 inch in width, with a scale common to both tubes. The uncorrected height of the mercury in each tube was recorded twice daily from January 1837 to June 1843. Now, the mercury in the crown glass tube ought theoretically to have stood somewhat higher than in the flint glass tube, on account of capillary action being more effective in the latter, which has the smaller bore; but this was not the case, and its readings were the lower of the two. There is, therefore, reason to believe that the air was not thoroughly expelled in filling the crown glass tube; and an increasing divergence of the readings shows that the deterioration of the vacuum was, though slowly yet surely, in progress during the 6½ years of simultaneous observations. Taking the first six months of the year, when the Assistant Secretary of the Royal Society alone was the observer, the average difference was, in 1837, 0·0052 in.; 1838, 0·0060 in.; 1839, 0·0063 in.; 1840, 0·0071 in.; 1841, 0·0071 in.; 1842, 0·0072 in.; and in 1843, 0·0073 in. This barometer is still in existence. After the observations were discontinued, in 1843, no use seems to have been made of it, and it was subsequently dismounted and handed over to Messrs. Negretti and Zambra for repair, the tubes being all but empty. They were quite emptied, carefully cleaned and refilled by the late Mr. Negretti himself, who boiled the mercury in the tubes in the usual manner, and erected the instrument at the Kew Observatory. The mercury in the crown glass tube is now 0·0006 in. higher than in the flint glass; and in the two tubes, from a mean of 56 readings between 29·5 ins. and 30·5 ins., respectively 0·0054 in. and 0·0048 in. higher than in the Kew standard, the latter being practically identical in its indications with the Greenwich standard. Mr. Whipple, in a private communication, writes, "In any case the operation of filling the tubes has been more successfully performed than it must have been done in years past, for the two tubes now have columns practically identical in length. The old difference must certainly have been due to bad exhaustion of the crown glass tube. Undoubtedly both tubes stand higher now than either Kew or Greenwich standards, and the problem

is an enigma. We are thinking of erecting another large standard here of a siphon form, in order to test our other standards, but unfortunately at present we are unable to find a suitable position in the building where to fix it." There is no record of barometer No. 2 having been tested with No. 3. Between the latter and No. 4, the Greenwich standard barometer, six comparisons were made, of which one observation was rejected by the Astronomer Royal. Of the remainder, "the resulting difference between the Royal Observatory barometer and the Royal Society's flint glass standard barometer was 0·001 in., the Royal Observatory barometer reading higher by that amount."* Experience, however, has proved that the comparisons were not nearly numerous enough to ascertain the difference, if any, between the indications of the two instruments,† and it is assumed in this Paper that their corrected readings are identical. The following comparison between the average monthly readings of No. 3, at Somerset House, and No. 4, at the Royal Observatory, Greenwich, shows a close accordance, nearer, indeed, than might have been expected from the character of the Royal Society observations.

Mean readings of Barometer No. 3 at the Royal Society, Somerset House, and of Barometer No. 4 at the Royal Observatory, Greenwich, corrected for capillarity, diurnal range and deficient observations, and reduced to 32° and mean sea level.

Month.	1840-1.			1841-2.			1842-3.		
	R. S. No. 3.	R. O. No. 4	R. S. higher.	R. S. No. 3.	R. O. No. 4.	R. S. higher.	R. S. No. 3.	R. O. No. 4.	R. S. higher.
	Ins.	Ins.	In.	Ins.	Ins.	In.	Ins.	Ins.	In.
December ..	30·194	30·196	—0·002	29·752	29·755	—0·003	30·170	30·168	+0·002
January....	29·867	29·863	+ ·004	30·082	30·080	+ ·002	29·840	29·842	— ·002
February ..	29·861	29·859	+ ·002	30·050	30·047	+ ·003	29·675	29·669	+ ·006
March	29·981	29·974	+ ·007	29·939	29·918	+ ·021	29·958	29·950	+ ·008
April	29·902	29·900	+ ·002	30·102	30·102	·000	29·866	29·871	— ·005
May	29·918	29·919	— ·001	29·966	29·963	+ ·003	29·825	29·826	— ·001
June	29·983	29·986	— ·003	30·061	30·061	·000	29·884	29·883	+ ·001
July	29·883	29·885	— ·002	30·004	30·001	+ ·003	..	..	..
August ..	29·938	29·935	+ ·003	30·053	30·052	+ ·001	..	..	..
September..	29·810	29·806	+ ·004	29·884	29·885	— ·001	..	..	..
October ..	29·621	29·612	+ ·009	30·038	30·033	+ ·005	..	..	..
November ..	29·832	29·829	+0·003	29·773	29·771	+0·002	..	..	..
Average....	..	..	..	..	..	..	29·926	29·924	+0·002

From the commencement of the Greenwich series, in December 1840, to the end of the year 1847, being the time when two-hourly observations were made, only one or two readings of the barometer were taken on Sundays and holidays, which were excluded in calculating the monthly averages, the object being to ascertain the diurnal variation of atmospheric pressure rather than the mean pressure. The values of the latter, as contained in the volumes of Greenwich observations, are therefore the mean of only 25 or 26 days

* Introduction to the Greenwich Magnetical and Meteorological Observations, 1840-1, p. lxxiv.

† On the Comparison of the Standard Barometers of the Royal Observatory, Greenwich, and the Kew Observatory, by G. M. Whipple. Proceedings of the Royal Society of London, Vol. XXVII., p. 76.

observations. But so many blanks in every month are, for the purpose of the present inquiry, too serious to be disregarded. To supply the deficiencies, in order to calculate the absolute monthly pressures, corrections have been found by interpolating values derived from a graphic projection of the curve of pressure, using such observations as were made to determine its probable direction, which was further checked by reference to contemporaneous meteorological registers in the possession of the Society.

From the curve thus obtained for every missing day, 12 readings, corresponding to the two-hourly week-day observations, furnished the means for deducing the necessary corrections, which are embodied in the following Table :—

Corrections, for deficient observations, applied to the average monthly readings of the Barometer, at the Royal Observatory, Greenwich.

Month.	1840.	1841.	1842.	1843.	1844.	1845.	1846.	1847.
	In.	In.	In.	In.	In.	In.	In.	In.
January ..	..	—0·022	—0·007	—0·012	+0·013	—0·012	+0·008	—0·008
February	..	— ·020	— ·010	+ ·015	+ ·006	— ·017	+ ·007	+ ·001
March ..	..	+ ·011	— ·007	+ ·012	— ·008	+ ·030	+ ·006	— ·023
April	..	— ·009	+ ·008	+ ·006	— ·007	·000	— ·008	— ·009
May	..	+ ·013	+ ·007	— ·014	+ ·002	·000	+ ·001	— ·004
June	..	+ ·001	— ·014	+ ·008	+ ·002	+ ·015	+ ·003	+ ·009
July	..	— ·005	+ ·007	— ·013	— ·016	+ ·009	+ ·005	— ·003
August ..	..	— ·006	+ ·010	+ ·008	·000	+ ·004	+ ·006	— ·008
September	..	+ ·008	— ·005	+ ·006	+ ·006	— ·021	— ·008	+ ·001
October ..	..	+ ·001	+ ·005	— ·001	+ ·011	+ ·020	— ·002	+ ·008
November	..	— ·022	— ·007	+ ·008	— ·015	+ ·018	+ ·004	— ·039
December	+0·019	+0·001	—0·019	—0·005	+0·007	+0·015	+0·011	+0·002

The corrections for diurnal range of pressure, required by the observations being taken at irregular hours of the day, have been based upon the reduction of twenty years' photographic records of the barometer made at the Royal Observatory, Greenwich, 1854—1878,* and have been applied as necessary to the whole series of observations at Somerset House and Greenwich, excluding those for the years 1841 to 1847 at Greenwich, when the two-hourly eye-observations were made, which have been unaltered, excepting the corrections for deficient observations. This course has been pursued in preference to adopting for the period 1854 to 1878 the values for the individual months found from the photographic records, since comparison of the two sets of results shows that they essentially agree. Mr. Ellis kindly supplied the necessary information for substituting the values derived from the photographic results for those based on five years' two-hourly eye-observations, which had been used in the reduction of the Greenwich observations from 1848.

It is not deemed necessary to give details of the reductions for diurnal range for every year; one example will suffice, viz. for the year 1815, in which year the amount of alteration was largest, and all the corrections were additive :— The correction was for January +0·004 in., February +0·004 in., March

* Reduction of Greenwich Meteorological Observations. Table XIV., p. 15.

+0·004 in., April +0·003 in., May +0·004 in., June +0·002 in., July +0·001 in., August +0·004 in., September +0·005 in., October +0·008 in., November +0·004 in., and December +0·003 in. The hours of observation were, in January, February, March, November and December, 8 a.m. and 3 p.m.; in April till the 10th, 7.30 a.m. and 3 p.m.; from April 11th to the end of the month, also in May, June, July, September and October, 7 a.m. and 3 p.m.; and in August 7 a.m. and 4 p.m.

Lastly, for the reduction to mean sea level, tables were prepared in which the addition to be made was shown for every degree of temperature of the air at intervals of 0·1 in. of atmospheric pressure. The height of the cistern of the barometer above the level of the sea was, from 1774-1822, 78 feet, 1823-1840, 97 feet, and from 1841-1879, 159 feet.

The following Table is an abstract of the three Tables used :—

READING OF THE BAROMETER AT THE UPPER STATION.

Temp. of the Air.	Ins. 29·3	Ins. 29·5	Ins. 29·7	Ins. 29·9	Ins. 30·1	Ins. 30·3
Height of Cistern of the Barometer above Mean Sea Level, 78 feet.						
°	In.	In.	In.	In.	In.	In.
70	0·081	0·082	0·082	0·083	0·084	0·084
60	·083	·084	·084	·085	·086	·086
50	·085	·086	·086	·087	·088	·088
40	·086	·087	·087	·088	·089	·089
30	0·088	0·089	0·089	0·090	0·091	0·091
Height of Cistern of the Barometer above Mean Sea Level, 97 feet.						
°	In.	In.	In.	In.	In.	In.
70	0·100	0·101	0·102	0·103	0·103	0·104
60	·103	·104	·105	·106	·106	·107
50	·105	·106	·107	·108	·108	·109
40	·108	·109	·110	·111	·111	·112
30	0·110	0·111	0·112	0·113	0·113	0·114
Height of Cistern of the Barometer above Mean Sea Level, 159 feet.						
°	In.	In.	In.	In.	In.	In.
70	0·165	0·166	0·167	0·169	0·170	0·171
60	·168	·169	·170	·172	·173	·174
50	·172	·173	·174	·176	·177	·178
40	·175	·176	·177	·179	·180	·181
30	0·179	0·180	0·181	0·183	0·184	0·185

In the final Tables, the results from 1774 to the end of 1840 depend on the Royal Society observations taken generally twice daily; from 1841 to 1847 on the Greenwich two-hourly eye-observations, and from 1848 to the end of the period on the Greenwich eye-observations usually taken four times daily; all corrections being applied as explained.

MEAN PRESSURE OF THE AIR IN LONDON, REDUCED TO SEA LEVEL.

Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
1774	29·677	29·900	29·903	29·855	29·918	29·929	30·026	29·982	29·837	30·200	29·898	30·192	29·943
1775	29·930	29·851	29·888	30·091	30·070	29·917	29·903	29·887	29·820	29·935	29·851	30·156	29·942
1776	29·813	29·499	30·013	30·110	30·059	29·898	29·932	29·891	29·864	30·090	29·954	29·974	29·925
1777	29·880	29·777	29·856	30·029	29·830	29·994	29·924	30·068	30·121	29·874	30·044	29 884	29·940
1778	29·817	29·889	29·857	29·838	29·940	30·077	29·973	30·181	30·031	29·674	29·771	29·940	29·916
1779	30·387	30·332	30·270	30·023	29·940	29·961	29·928	30·072	29·946	30·026	29·711	29·764	30·030
1780	29·904	30·046	29·996	29·726	29·993	30·055	30·054	30·082	29·872	29·739	29·953	30·401	29·985
1781	30·015	29·905	30·283	29·948	30·084	29·871	30·097	29·950	..	..	..	..	..
1782	..	..	..	..	..	..	..	..	..	..	..	..	..
1783	..	..	..	..	..	..	..	..	..	..	..	..	..
1784	..	..	..	..	..	..	..	..	..	..	..	..	..
1785	..	..	..	..	..	..	..	..	..	..	..	..	..
1786	..	..	..	..	..	..	..	..	..	..	..	..	..
1787	30·270	29·978	29·867	29·995	29·967	29·938	29·853	30·031	29·988	29·781	29·882	29·756	29·942
1788	30·104	29·679	29·760	30·167	30·081	29·978	30·018	29·983	29·904	30·207	30·178	30·023	30·007
1789	29·825	29·764	29·790	29·743	29·929	29·885	29·889	30·089	29·946	29·750	29·780	29·934	29·860
1790	30·149	30·329	30·335	29·928	29·948	30·083	29·881	30·008	30·055	29·952	29·888	29·953	30·042
1791	29·634	30·026	30·277	29·824	30·073	29·973	29·930	30·091	30·144	29·749	29·755	29·728	29·934
1792	29·744	30·061	29·848	29·949	30·036	29·946	29·923	29·964	29·841	29·850	30·088	29·921	29·931
1793	30·105	29·878	29·917	29·961	30·094	30·011	30·057	29·990	30·030	30·047	29·866	29·810	29·981
1794	30·141	29·926	30·048	29·959	30·024	30·079	30·014	29·945	29·897	29·878	29·809	30·015	29·978
1795	30·123	29·689	29·879	29·851	30·224	29·914	30·023	30·006	30·125	29·719	29·950	30·035	29·961
1796	29·786	29·881	30·111	30·100	29·790	30·005	29·834	30·097	30·004	30·009	29·886	29·927	29·953
1797	30·186	30·400	30·016	29·828	29·919	29·914	29·999	29·911	29·798	29·905	30·005	29·881	29·980
1798	30·029	30·190	30·010	30·018	30·064	30·108	29·839	30·125	29·823	29·959	29·657	29·983	29·984
1799	30·081	29·793	29·923	29·696	29·904	30·101	29·864	29·861	29·855	29·872	29·952	30·020	29·910
1800	29·581	29·955	29·947	29·742	29·890	30·068	30·240	30·078	29·811	29·978	29·747	29·730	29·897
1801	29·919	29·854	29·942	30·114	29·875	30·093	29·811	30·093	29·944	29·895	29·792	29·563	29·908
1802	30·040	29·849	30·134	30·086	30·072	29·952	29·899	30·072	30·095	29·864	29·712	29·817	29·966
1803	29·753	29·965	30·106	29·949	30·018	30·074	30·170	30·095	30·176	30·137	29·584	29·691	29·977
1804	29·683	30·124	29·708	29·782	29·976	30·157	29·855	29·927	30·176	29·767	29·921	29·892	29·914
1805	29·704	29·912	30·038	29·894	29·966	30·058	29·969	29·961	30·048	29·962	30·337	29·776	29·969
1806	29·604	29·924	29·802	30·096	29·946	30·148	29·852	29·892	30·071	29·944	29·836	29·674	29·899
1807	30·148	29·863	30·171	29·996	29·876	30·076	29·973	29·944	29·887	29·945	29·614	30·028	29·960
1808	29·938	30·190	30·210	29·942	29·976	30·021	29·984	29·917	29·872	29·807	29·903	29·869	29·969
1809	29·608	29·824	30·126	29·857	29·962	29·973	29·894	29·798	29·777	30·220	30·019	29·650	29·892
1810	30·221	29·954	29·770	29·878	29·944	30·135	29·850	29·926	30·070	29·991	29·537	29·816	29·924
1811	29·989	29·624	30·187	29·790	29·824	29·945	30·036	29·975	30·048	29·734	30·081	29·846	29·923
1812	29·975	29·743	29·857	30·010	29·946	30·011	30·037	30·041	30·134	29·573	29·935	30·062	29·944
1813	30·212	29·937	30·276	30·027	29·849	30·076	29·925	30·146	30·059	29·713	29·864	29·908	29·999
1814	29·655	30·181	29·847	29·920	30·044	30·071	29·811	30·010	30·117	29·866	29·825	29·770	29·926
1815	29·956	29·905	29·836	29·940	29·974	29·904	30·092	30·008	30·032	29·949	30·073	29·897	29·964
1816	29·777	29·961	29·860	29·773	29·884	29·957	29·706	29·969	29·979	29·884	29·855	29·825	29·869
1817	29·931	30·036	29·937	30·308	29·790	29·909	29·871	29·770	30·005	30·043	30·052	29·696	29·946
1818	29·921	29·841	29·720	29·771	29·916	30·077	30·097	30·131	29·916	29·943	29·930	30·171	29·953
1819	29·883	29·753	29·969	29·857	29·913	29·964	30·030	30·038	30·010	29·791	29·807	29·804	29·902
1820	29·992	30·051	29·976	29·998	29·843	30·001	29·993	29·932	30·048	29·689	29·930	30·036	29·957
1821	29·996	30·354	29·713	29·721	29·935	30·103	29·973	29·976	29·910	29·969	29·865	29·579	29·925
1822	30·213	30·199	30·118	30·004	30·031	30·118	29·834	29·943	30·014	29·739	29·854	30·170	30·020
1823	29·783	29·545	29·910	29·933	30·000	29·977	29·892	29·963	30·060	29·794	30·191	29·860	29·909
1824	30·161	29·915	29·898	29·955	30·035	29·954	30·065	29·991	29·944	29·723	29·728	29·914	29·940
1825	30·324	30·249	30·191	30·074	30·026	30·040	30·160	29·976	29·926	30·020	29·795	29·639	30·035
1826	30·132	30·037	30·046	30·013	30·030	30·234	29·946	29·988	29·932	29·948	29·871	29·947	30·010
1827	29·932	30·124	29·765	30·021	29·816	29·976	30·120	30·038	30·028	29·807	30·060	29·900	29·966
1828	30·013	29·880	29·971	29·814	29·897	30·020	29·730	29·886	29·959	30·125	29·054	30·039	29·940
1829	29·862	30·133	29·912	29·590	30·077	30·055	29·836	29·917	29·798	30·072	30·041	30·201	29·958

MEAN PRESSURE OF THE AIR IN LONDON, REDUCED TO SEA LEVEL.

Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
1830	30·055	29·978	30·145	29·801	29·897	29·852	29·970	29·910	29·811	30·269	29·886	29·680	29·938
1831	29·922	29·906	29·920	29·749	29·932	29·970	29·976	29·945	29·936	29·903	29·943	29·840	29·912
1832	30·051	30·138	29·965	30·030	29·971	29·878	30·108	29·882	30·144	30·106	29·907	30·024	30·017
1833	30·282	29·597	29·904	29·795	30·121	29·834	30·017	29·976	29·914	29·853	29·974	29·756	29·919
1834	29·794	30·215	30·266	30·200	30·042	30·005	29·950	29·891	30·102	30·081	29·994	30·364	30·075
1835	30·148	29·905	29·995	30·159	29·903	30·054	30·061	29·986	29·749	29·830	30·008	30·241	30·003
1836	30·006	29·873	29·595	29·895	30·206	29·936	29·988	30·048	29·884	29·871	29·689	29·869	29·905
1837	30·011	30·013	30·031	29·845	29·989	30·033	29·996	30·011	29·923	30·159	29·907	30·028	29·996
1838	29·989	29·671	29·874	29·835	29·934	29·897	30·013	29·943	30·014	30·028	29·616	30·145	29·913
1839	29·964	30·048	29·872	30·131	29·985	29·931	29·930	30·019	29·692	30·060	29·748	29·784	29·930
1840	29·869	29·989	30·309	30·098	29·934	30·006	29·913	29·953	29·833	30·011	29·689	30·194	29·983
1841	29·863	29·859	29·974	29·900	29·919	29·986	29·885	29·935	29·806	29·612	29·829	29·755	29·860
1842	30·080	30·047	29·918	30·102	29·963	30·061	30·001	30·052	29·885	30·033	29·771	30·168	30·007
1843	29·842	29·669	29·950	29·871	29·826	29·883	29·987	30·000	30·198	29·780	29·905	30·423	29·944
1844	30·087	29·685	29·882	30·171	30·125	29·990	29·910	29·851	30·063	29·750	29·854	30·077	29·954
1845	29·873	30·007	30·008	29·874	29·889	29·964	29·952	29·907	29·956	30·045	29·771	29·852	29·925
1846	29·858	30·036	29·840	29·759	29·956	30·042	29·934	29·956	29·990	29·690	30·004	29·891	29·913
1847	29·912	29·967	30·047	29·822	29·936	29·989	30·096	30·043	30·002	29·988	30·046	29·873	29·977
1848	30·000	29·695	29·684	29·767	30·100	29·816	30·010	29·897	30·008	29·824	29·963	29·987	29·896
1849	29·953	30·291	30·102	29·697	29·943	30·043	29·963	30·015	29·941	29·925	29·924	29·979	29·981
1850	30·039	30·010	30·227	29·773	29·891	30·060	29·963	29·962	30·107	29·864	29·908	30·098	29·992
1851	29·829	30·076	29·785	29·906	30·070	30·069	29·882	30·065	30·201	29·907	29·965	30·320	30·006
1852	29·769	30·042	30·195	30·127	29·964	29·733	30·031	29·822	29·913	29·869	29·643	29·760	29·906
1853	29·750	29·710	29·968	29·890	29·931	29·902	29·902	29·968	30·007	29·739	30·124	29·990	29·907
1854	29·800	30·227	30·374	30·166	29·844	29·909	29·982	30·065	30·207	29·906	29·877	29·951	30·026
1855	30·183	29·780	29·721	30·115	29·857	30·038	29·943	30·049	30·142	29·707	30·047	29·946	29·961
1856	29·648	30·083	30·200	29·794	29·825	30·051	30·006	29·919	29·828	30·174	30·086	29·827	29·953
1857	29·816	30·136	29·905	29·812	29·963	30·031	30·021	30·009	29·960	29·876	30·124	30·342	29·999
1858	30·357	30·028	29·948	29·960	29·952	30·087	29·956	30·000	30·040	30·016	29·933	29·953	30·019
1859	30·220	30·006	29·991	29·794	29·967	29·938	30·110	29·992	29·883	29·703	30·006	29·806	29·951
1860	29·695	30·044	29·843	29·978	29·923	29·787	30·021	29·731	29·938	30·039	29·878	29·673	29·879
1861	30·197	29·868	29·799	30·182	30·103	29·955	29·780	30·040	29·891	30·023	29·743	30·158	29·978
1862	29·887	30·090	29·682	30·028	29·902	29·892	29·937	29·960	30·035	29·907	29·976	30·048	29·945
1863	29·801	30·326	29·900	29·993	30·036	29·900	30·137	29·917	29·868	29·819	30·052	30·125	29·990
1864	30·229	29·946	29·688	30·096	30·014	29·966	30·031	30·094	29·952	29·866	29·807	30·048	29·978
1865	29·585	29·907	29·910	30·134	29·946	30·205	29·971	29·885	30·246	29·620	29·900	30·239	29·962
1866	29·882	29·711	29·712	29·923	29·992	29·947	29·945	29·812	29·749	30·110	29·968	29·966	29·893
1867	29·697	30·094	29·811	29·808	29·915	30·110	29·904	30·003	30·091	29·941	30·304	30·039	29·977
1868	29·923	30·154	30·010	29·962	30·021	30·153	30·065	29·909	29·866	29·976	30·019	29·556	29·968
1869	30·044	29·990	29·819	30·008	29·829	30·096	30·099	30·143	29·815	30·051	29·947	29·802	29·970
1870	30·006	29·878	30·053	30·165	30·075	30·121	29·991	29·979	30·083	29·752	29·819	29·918	29·987
1871	29·830	30·031	30·061	29·827	30·086	29·936	29·863	30·029	29·893	29·968	30·000	30·110	29·969
1872	29·642	29·826	29·810	29·914	29·912	29·907	29·932	29·973	29·855	29·714	29·690	29·592	29·813
1873	29·756	30·089	29·808	30·003	29·973	29·967	29·967	29·939	29·968	29·867	29·889	30·292	29·960
1874	30·073	30·038	30·200	29·883	29·982	30·114	30·000	29·958	29·927	29·889	29·961	29·797	29·985
1875	29·944	30·047	30·156	30·057	30·019	29·916	29·967	30·043	30·042	29·790	29·811	30·122	29·993
1876	30·280	29·810	29·575	29·860	30·136	29·990	30·076	29·942	29·795	29·938	29·883	29·490	29·898
1877	29·845	29·934	29·755	29·771	29·882	30·015	29·922	29·874	30·066	30·033	29·697	30·047	29·903
1878	30·161	30·283	30·071	29·840	29·793	29 944	30·037	29·758	29·994	29·784	29·751	29·728	29·929
1879	30·036	29·542	29·990	29·698	30·011	29·815	29·802	29·845	29·978	30·131	30·217	30·325	29·949

MEAN PRESSURE OF THE AIR IN LONDON, REDUCED TO SEA LEVEL, ARRANGED IN DECADES.

Period.	January.	February.	March.	April.	May.	June.	July.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
1774—1780 } 1787—1789 }	29·9607	29·8715	29·9200	29·9577	29·9727	29·9632	29·9500
1790—1799	29·9978	30·0173	30·0364	29·9114	30·0076	30·0134	29·9364
1800—1809	29·7978	29·9460	30·0184	29·9458	29·9557	30·0620	29·9647
1810—1819	29·9520	29·8935	29·9259	29·9274	29·9084	30·0049	29·9455
1820—1829	30·0408	30·0487	29·9500	29·9123	29·9690	30·0478	29·9549
1830—1839	30·0222	29·9344	29·9567	29·9440	29·9980	29·9390	30·0009
1840—1849	29·9337	29·9245	29·9714	29·9061	29·9591	29·9780	29·9651
1850—1859	29·9411	30·0098	30·0314	29·9337	29·9264	29·9818	29·9796
1860—1869	29·8940	30·0130	29·8174	30·0112	29·9681	30·0011	29·9890
1870—1879	29·9573	29·9478	29·9479	29·9018	29·9869	29·9725	29·9557
100 years.	29·94974	29·96065	29·95755	29·93514	29·96519	29·99637	29·96418

Period.	August.	September.	October.	November.	December.	Year.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
1774—1780 } 1787—1789 }	30·0266	29·9329	29·9276	29·9022	30·0024	29·9490
1790—1799	29·9998	29·9572	29·8940	29·8856	29·9273	29·9654
1800—1809	29·9777	29·9857	29·9519	29·8465	29·7690	29·9351
1810—1819	30·0014	30·0370	29·8487	29·8959	29·8795	29·9350
1820—1829	29·9610	29·9619	29·8886	29·9289	29·9285	29·9660
1830—1839	29·9611	29·9169	30·0160	29·8672	29·9731	29·9608
1840—1849	29·9609	29·9682	29·8658	29·8756	30·0199	29·9440
1850—1859	29·9851	30·0288	29·8761	29·9713	29·9993	29·9720
1860—1869	29·9494	29·9451	29·9352	29·9594	29·9654	29·9540
1870—1879	29·9340	29·9601	29·8866	29·8718	29·9421	29·9387
100 years.	29·97570	29·96938	29·90905	29·90044	29·94065	29·95200

DISCUSSION.

Mr. ELLIS testified to the great care and trouble which Mr. Eaton had taken in the preparation of this Paper, remarking that the Table now given was by no means a mere extension of that contained in a former volume of the Proceedings, but the result of a complete re-discussion of the observations from the beginning. One point brought out was the difficulty of determining periodical barometric variations in this latitude as compared with tropical stations, at which the periodical variations were comparatively large, and the accidental variations small, just an opposite condition to that existing in our latitude. This was seen in the different character of the annual curve for different periods of 20 years, gathered from Mr. Eaton's Table, as compared with the curve for 100 years.

Mr. WHIPPLE inquired whether the subsidiary dips in the curve, in April and July, were due to any abnormal months, or whether they were borne out by a number of observations.

Mr. STRACHAN said that the main fact brought out in the curve of mean pressure was that the absolute maximum fell in June and the absolute minimum in November, and even another 100 years of observations, it might safely be assumed, would not alter the positions of these points of the curve.

Mr. C. HARDING said that in the Greenwich curve, for 20 years, there were no dips in April and July. He thought the agreement between the 20 years' average and that for 100 years was striking.

The PRESIDENT (Mr. Symons) thought it would be very interesting if Mr. Eaton would give a chart showing the annual fluctuations of atmospheric pressure.

"*Results of Meteorological Observations made at Stanley, Falkland Islands,* 1875-77." By WILLIAM MARRIOTT, F.M.S., Assistant-Secretary.

[Read June 16th, 1880.]

SCARCELY anything being known of the climate of the Falkland Islands, Mr. F. E. Cobb's offer to place his observation books in the hands of the Society was gladly accepted. These observations were made at Stanley Harbour, on the east coast of East Falkland: lat. 51°41′ S, long. 57°51′ W. The observations were made at 9 a.m. throughout the 3 years 1875-77; others were occasionally made at 9 p.m., but these are not sufficiently numerous to be utilised in the present paper. An aneroid was used till April 12th, 1875, but as its index-error is unknown, its readings have not been reduced. On April 13th a standard Fortin barometer was set up, and employed during the remainder of the period. The thermometers were mounted in a Stevenson Screen over grass, on ground gently sloping towards the harbour, and were about 60 feet from the shore. The thermometers were standard instruments of Casella's make, but had not been verified; they, however, appear to be fairly correct, the readings of the several instruments agreeing very closely together. A Robinson's anemometer was mounted on a pole, and read daily during the greater part of 1876 and 1877.

As the observations extend only over 3 years, the period is too short to give reliable mean results. A few brief remarks may, however, be made upon some of the special characteristics of the climate.

Atmospheric pressure is very variable, rapid changes constantly occurring. The mean pressure for 1876 was 29·616 ins., and for 1877, 29·575 ins.; the highest monthly mean during the 3 years was 29·761 ins., in September, 1875, and the lowest 29·342 ins., in February 1876. The maximum observed pressure was 30·479 ins. on July 31st, 1877, at 9 a.m., and the minimum observed pressure 28·559 ins. on September 19th, 1877, at 9 a.m. The warmest month is January, and the coldest July. The annual mean temperature is about 43°. The maximum temperature registered during the 3 years was 76°·0 on January 27th, 1877, and the minimum 18°·9 on July 17th, 1877. Both solar and terrestrial radiation are great, the black bulb thermometer rising considerably in the day, and the minimum thermometer on the grass falling much below the air temperature at night.

Although the rainfall is not large, the annual amount being about 20 ins., yet the number of rainy days is considerable, the rain falling generally in small quantities. The distribution of the days of rain, snow, hail, thunderstorms and fog is shown by symbols in the accompanying tables.

The wind is very variable owing to frequent squalls, but the prevalent direction is from the west. The average daily velocity of the wind is about 340 miles; the greatest velocity recorded during 24 hours was 799 miles on June 18th, 1877, and the least 66 miles on July 1st, 1877.

Abstract of Meteorological Observations made at Stanley, Falkland Islands, for the Year 1875.

Month.	Mean Pressure at 9 a.m.	Air Temperature.							Wet Bulb Therm.	Relative Humidity.	Black Bulb Ther. *in vacuo*.		Min. on Grass.		Amount of Cloud.	Rainfall.			Rain, Snow or Hail.	Wind.								
			Means of		Absolute Min. and Max.											Total Fall.	Greatest Fall in 24 hours.			No. of Observations of								
		9 a.m.	Min.	Max.	Min.	Date.	Max.	Date.	9 a.m.	9 a.m.	Max.	Mean.	Min.	Mean.	9 a.m.		Amnt.	Date.		N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°		°		°	o/o	°	°	°	°		In.	In.		Days									
January	..	50·9	42·6	55·5	36·0	25	64·0	20	46·3	71	150·5	129·8	27·4	38·9	7·4	3·27	·56	26	21	1	0	0	0	4	12	7	7	0
February	..	50·2	42·0	55·3	37·1	16	64·1	4	46·6	77	143·0	123·2	27·0	35·8	7·6	3·32	1·69	14	18	2	0	0	0	4	7	7	8	0
March	..	50·9	43·2	55·4	32·8	13	67·0	18	47·8	80	141·2	117·6	25·4	37·6	5·6	1·76	·44	3	17	2	1	0	0	0	9	9	10	0
April	..	43·9	38·3	48·7	32·9	25	58·0	19	41·5	82	118·5	89·5	25·9	31·8	5·2	2·40	·31	11	24	1	0	1	1	1	8	13	3	2
May	29·550	41·3	36·9	45·1	24·0	12	51·0	14	39·8	88	90·5	69·1	?	31·6	..	1·45	·38	26	15	4	3	5	0	0	1	12	6	0
June	·754	38·5	35·5	41·5	29·1	26	45·7	4	37·2	89	84·0	64·6	24·0	30·2	7·5	1·43	·24	3	18	2	0	3	3	4	3	9	5	1
July	·579	36·0	32·9	41·2	27·2	26	48·1	15	35·5	96	89·0	72·8	22·2	27·6	6·9	1·18	·14	14	17	2	0	0	2	4	4	12	5	2
August	·652	39·3	33·6	43·5	23·7	30	51·9	19	37·8	88	109·0	88·5	19·7	28·1	6·3	·91	·26	2	16	2	0	0	0	4	2	13	7	3
September	·761	42·8	35·6	47·8	28·7	2, 23	53·8	19	39·5	76	125·2	109·9	19·8	29·4	4·9	·84	·17	2	14	1	0	0	2	1	6	15	4	1
October	·710	43·4	36·3	47·9	29·7	12	58·9	27	40·8	80	148·9	120·2	19·5	30·7	7·4	1·07	·13	24	20	2	0	0	0	6	10	8	4	1
November	·750	47·6	40·4	52·1	33·0	10	68·2	11	43·5	72	146·0	128·5	23·8	35·4	6·9	1·24	·71	26	14	1	1	1	3	8	8	6	2	0
December	29·492	47·4	39·8	52·0	30·5	2	64·4	9	43·8	76	149·8	133·1	23·5	33·7	7·2	2·92	·68	17	25	3	3	3	3	4	6	7	2	0
Year	..	44·4	38·1	48·8	23·7	Aug. 30	68·2	Nov. 11	41·7	81·3	150·5	103·9	19·5	32·6	..	21·79	1·69	Feb. 14	219	23	8	13	14	40	76	118	63	10

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January	●	●	...	●	●	...	●	●	●	●▲	...	●	●	...	●	●	●	...	...	...	●	...	●	...	●	●T	●	●	●	...	●
February	●	...	...	...	●	●	●	●	●	●	●	●T	●	●	...	...	...	...	●	●	●	●	●	●▲	...	...	...	●≡	—	—	—
March	...	...	●	●	●	...	...	≡	≡<	●	●	●	●	●≡	●	●	...	...	...	...	●	●	●	...	●	...	...	●	●	...	●
April	●≡	...	●	●	...	●	●	●	●	●	●	●	●	●	●	...	●	●	...	...	●	●*	●	●▲	●	●	●	●	●	...	—
May	...	...	●	...	●≡	●K	...	●	●≡	●	●*	●*	●	...	...	≡	≡	...	●	...	●	...	...	...	●	●	...	...	●	●≡	...
June	...	...	●	*	...	...	...	...	●≡	...	●	●≡	●	●	●	●	●	●	●	●	●	●	...	...	...	...	●	●	●	●	—
July	●≡	●≡	≡	...	●	...	●≡	●	●	*	●	●	●*	●	...	...	...	●	...	...	...	...	...	●	...	●*	●	●*	...	●	●
August	●	●≡	●≡	...	...	●*	●	●	●	...	●	...	...	●	●	...	...	...	...	●	...	...	≡	...	...	●	●*	●*	●*	*	●*
September	...	●*	●	...	...	...	...	...	...	...	≡	●≡	●	●	●	≡	≡	...	...	●	●*	●*	●	●	●	...	...	●	...	●	—
October	●	...	...	●	...	...	...	●	●	●	●*	●	●	...	●	●	●	●	●	●	...	●	●	●	●	...	...	...	...	●≡	●
November	...	...	...	●	...	...	●	...	...	...	...	●	●	...	●	●	●*	●	...	...	...	...	●	...	...	●	●	●≡	●	●	—
December	●*	●	...	●	●≡	●	...	●	...	●	...	●	●≡	●	●	●	●	●	●▲	●	●	●	●	●	●▲	●	...	●	...	●	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ▲ hail; * snow; ≡ fog; K thunderstorm; T thunder; < lightning.

Month.	Mean Pressure at 9 a.m.	Air Temperature. 9 a.m.	Air Temperature. Means of Min.	Air Temperature. Means of Max.	Air Temperature. Absolute Min.	Date.	Air Temperature. Absolute Max.	Date.	Wet Bulb Therm. 9 a.m.	Relative Humidity 9 a.m.	Black Bulb Ther. *in vacuo.* Max.	Black Bulb Ther. *in vacuo.* Mean.	Min. on Grass. Min.	Min. on Grass. Mean.	Amount of Cloud 9 a.m.	Rainfall. Total Fall.	Rainfall. Greatest Fall in 24 hours. Amnt.	Date.	Rain, Snow or Hail.	Wind. Velocity. Miles.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°		°		°	0/0	°	°	°	°	°	In.	In.		Days										
January	29·454	49·0	41·3	53·4	33·2	5	61·3	13	45·4	75	149·4	132·0	23·9	34·2	7·8	3·27	1·24	30	24	364	2	0	1	0	3	15	5	5	0
February	·342	48·8	41·2	54·0	34·5	12	68·2	15	44·4	70	151·5	127·1	23·5	33·0	6·4	2·00	·35	26	22	..	1	1	0	2	3	7	11	4	0
March ..	·486	47·1	40·0	51·7	31·0	29	59·0	7	44·4	81	143·0	114·2	21·0	32·6	7·4	2·12	·32	3	22	..	6	1	1	1	2	5	9	5	1
April	·677	45·2	40·2	49·7	35·0	20	58·8	1	43·4	86	122·5	96·6	24·8	32·7	8·2	1·07	·24	17	21	..	2	0	1	0	2	5	13	7	0
May	·423	39·6	35·0	43·6	24·2	28	49·8	9	38·2	89	105·7	82·7	17·8	27·2	6·4	1·64	·28	28	21	..	2	0	0	0	2	8	11	6	2
June	·706	36·8	33·2	40·8	25·7	21	44·5	17	35·7	91	90·0	69·1	15·6	25·5	7·3	1·10	·27	10	19	..	1	2	1	0	3	4	10	4	5
July	·583	37·1	33·0	41·3	27·7	14	45·9	31	35·6	87	96·8	74·9	18·0	25·6	6·5	2·76	·43	20	22	339	6	1	0	0	3	4	14	2	1
August ..	·665	36·7	32·5	41·5	26·7	16	46·2	2	35·3	88	115·8	90·5	19·3	25·2	6·8	1·70	·45	20	28	317	1	0	1	0	4	6	10	5	4
September	·686	41·3	36·1	45·2	30·0	2	54·4	6	39·3	84	130·7	104·2	20·8	28·2	7·3	1·58	·45	15	14	297	2	1	1	0	4	6	8	7	1
October ..	·800	41·0	35·2	44·5	26·9	20	51·8	27	38·5	81	132·6	115·7	21·6	28·4	8·0	1·28	·16	7	24	341	5	2	1	3	6	11	2	1	0
November	·819	44·6	37·9	48·6	30·0	4	60·8	20	41·4	77	150·0	123·7	23·7	31·3	8·4	·91	·21	21	15	327	1	5	0	3	5	8	2	6	0
December	29·755	48·9	41·5	53·8	33·0	3	67·8	17	45·1	75	162·3	140·2	24·0	34·0	6·7	·99	·23	6	17	328	1	1	2	3	6	9	5	2	1
Year ..	29·616	43·0	37·3	47·3	24·2	May 28	68·2	Feb. 15	40·6	82 0	162·3	105·9	15·6	29·8	7·3	20·42	1·24	Jan. 30	249	330	30	14	9	12	43	88	100	54	15

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January	●▲	●	●	...	●	●	●	●	●▲	●	●	●	...	...	●	...	...	●ꓘ	...	●	●▲	●	●	●	●	●	●T≡	...	●	●	●
February	●	●	●	●	●	●	●	●	●	●▲	●	●	...	...	...	●	...	...	●	●	●	...	●	●	●	●ꓘ	●	...	●	—	—
March	...	...	●	●	●	●	●▲ꓘ	●	●	●	●≡	●	●	●	...	●⋖	≡	...	●≡	●	...	●	●	●	...	●	●	...	●	●	...
April	...	...	...	...	...	●	●	●≡	...	●	●≡	●	●	●	●≡	●	●	●	●	●	●	...	●	●	...	●	●	●	...	●	—
May	●▲	●	●	...	●	●	●▲	...	...	≡	...	...	●≡	●	●▲	...	●	●	●≡	●	●	●	●	●✳	●✳	●✳	●✳	●	...	...	≡
June	●	●	●≡	●	●✳	●	●	●✳	●ꓘ	●✳	●≡	●	●✳	●✳	...	...	...	●	...	...	...	...	●	●≡	●	...	≡	≡	●	≡	...
July	●	●	●	●	...	≡	●	●	...	●	●	...	●	●	...	●≡	●✳▲	●✳	●	●	...	...	●✳	...	●✳	..	●	●✳	●✳	●	●
August	...	●	●≡	...	≡	●	●✳	●✳	●	●	●	●✳	●	●	●	●	●	●	●	●	●	●	●	●	●	●✳	●✳	●	●	●	●
September	...	...	...	●	...	...	...	●	●	●✳	●	...	...	●	●	...	...	...	...	...	...	●	...	●▲	...	●	●	●	●	●	—
October	●	●	...	...	●	●	●	●	●	●	●	●	...	...	●	●	●✳	●	●✳	●	●	●	●	●	...	●	●≡	...	●	...	●
November	●	●	●✳	●✳	●	●	●	...	...	●	...	...	...	...	●	...	...	...	...	...	●	●	...	...	...	●	●	...	●	●	—
December	●	●	●	●	●	●	●	...	●	...	..	●	...	...	●	●	...	...	...	●	...	≡	...	●ꓘ≡	...	...	●	●	●	●	...

EXPLANATION OF THE SYMBOLS.—● indicates rain; ▲ hail; ✳ snow; ≡ fog; ꓘ thunderstorm; T thunder; ⋖ lightning.

Abstract of Meteorological Observations made at Stanley, Falkland Islands, for the Year 1877.

Month.	Mean Pressure at 9 a.m.	Air Temperature. 9 a.m.	Means of Min.	Means of Max.	Absolute Min.	Date.	Absolute Max.	Date.	Wet Bulb Therm. 9 a.m.	Relative Humid. 9 a.m.	Black Bulb Ther. *in vacuo*. Max.	Black Bulb Mean.	Min on Grass. Min.	Min on Grass. Mean.	Amount of Cloud. 9 a.m.	Rainfall. Total Fall.	Greatest Fall in 24 hours. Amnt.	Date.	Rain, Snow, or Hail.	Wind. Velocity. Miles.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°		°		°	o/o	°	°	°	°		In.	In.		Days										
January	29·638	53·8	45·8	59·5	37·0	24	76·0	27	49·0	70	165·0	139·5	23·0	37·4	6·4	1·60	·21	19	19	388	0	0	2	1	3	10	10	5	0
February	·646	50·1	42·7	55·9	33·0	8	69·0	19	47·1	80	140·6	124·8	20·8	34·3	7·5	1·23	·29	5	18	328	1	1	1	1	5	6	9	3	1
March ..	·713	51·2	45·1	55·8	34·0	30	66·4	16	48·6	83	138·8	114·6	24·8	36·6	6·9	1·20	·22	19	16	382	3	0	0	0	2	5	12	8	0
April	·475	43·7	36·9	48·8	30·9	22	56·5	5	41·6	84	125·0	104·3	18·7	26·9	5·7	2·54	·64	3	22	301	1	1	2	0	2	5	10	7	2
May	·536	40·7	35·8	45·1	28·8	17	50·7	7	39·7	92	104·8	80·2	19·0	27·7	7·4	1·98	·29	1	22	348	1	1	2	1	1	4	10	10	1
June	·598	38·3	33·8	42·1	25·5	7	48·2	10	37·3	92	93·2	70·8	12·2	25·8	7·9	1·78	·28	26	23	348	0	0	0	0	2	7	11	8	2
July	·714	35·5	31·2	39·5	18·9	17	46·0	12	34·5	91	96·0	68·2	9·1	24·2	8·2	1·57	·43	9	22	288	5	1	0	2	3	5	4	2	9
August ..	·647	37·2	33·3	41·2	25·8	27	49·2	9	36·0	89	108·7	84·2	15·9	25·3	6·9	·90	·10	19	22	334	1	1	4	1	1	5	3	11	4
September	·422	38·0	32·5	42·6	22·7	15	53·0	4	36·1	84	129·0	109·8	13·9	24·1	6·4	1·02	·18	18	19	364	1	0	0	1	3	8	12	5	0
October ..	·537	41·8	35·3	46·7	28·0	29	57·9	6	39·6	84	147·5	119·8	21·4	27·8	7·7	1·71	·25	3	20	370	2	0	1	2	2	9	8	4	3
November	·565	46·4	38·9	51·1	32·6	16	58·8	19	43·2	78	158·2	130·3	22·4	31·7	8·5	1·27	·19	2	17	350	1	3	2	0	4	9	8	3	0
December	29·391	48·0	40·2	53·3	31·8	10	61·5	6	44·7	77	156·2	137·9	23·5	31·7	8·3	1·97	·36	27	21	325	2	1	1	0	3	9	10	5	0
Year ..	29·574	43·7	37·6	48·5	18·9	July 17	76·0	Jan. 27	41·5	83·7	165·0	107·0	9·1	29·5	7·3	18·77	0·64	Apr. 3	241	344	18	9	15	9	31	82	107	71	22

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January	...	...	●	...	...	≡	●	●	...	●	●	●	●	●	●	...	...	...	●	...	●	●	●	●	●	●	...	●	●	...	●
February	●▲	●	●	●	●	●≡	●	●	...	...	●	●	●	...	...	●	...	...	...	≡	●K≡	...	●	●	●▲	●	...	●	—	—	—
March	...	●	●	●	...	...	...	...	●	●	...	●	●	●	●≡	≡	...	...	●	●	...	...	...	●	...	...	●	●	●	●	...
April	...	●	●	●≡	●	●	●	●*▲	...	●	●	●	...	●	●	●	...	●	●	●	●	●	●	●	●	...	...	●	...	...	—
May	●≡	...	...	●	...	...	●	●*	●	●≡	...	...	...	...	●	●	●	●*	●	●	●	●	●	●	...	●	●	●	●≡	●	●
June	●	●	●≡	●*	●*	●	●	●	...	●	●	●	●	...	●≡	●	...	...	●	●	...	...	...	●	●	●*	●	●*	●	●*	—
July	...	●	●	●	...	*	●*	●	●	●≡	●	●	●≡	●≡	●*	...	●	●	≡	●	●	●	...	●	...	...	●	●	●	●	...
August	●	●	...	...	...	●	●	●	●≡	●	●	●	●*	...	●	●*	...	...	●	●	●*≡	●*	●	●*	●▲	●*	...	...	●	●	...
September	...	...	...	...	...	...	...	...	●	●	●	●*	●*	●*	●*	●*	*	●	●	●	●	●*	...	●	●	●*	●*	●	●	...	—
October	●	...	●	...	...	●	●	...	...	...	...	●	...	...	●	●	●	●	●	●	●*	●*	●	●	●	●	●	●*	●*	●	●
November	●	●	●	...	...	●	...	...	●	...	...	...	...	...	●	●	●	●	●	●	●	●	...	●	●	...	...	●	...	●	—
December	...	●	●	●	...	●K	●T	●	●	●	●	●	...	...	●	●	≡	●	...	≡	...	●	●▲	●	●	...	●	...	●	●	●≡

EXPLANATION OF THE SYMBOLS.—● indicates rain; ▲ hail; * snow; ≡ fog; K thunderstorm; T thunder; < lightning.

The Winter Climate of Davos. By C. THEODORE WILLIAMS, M.A., M.D., F.R.C.P., F.M.S.

[Read June 16th, 1880.]

THE effect of mountain climates on health and disease is a subject which, at the present moment, is largely interesting the medical profession and the general public. A great therapeutic experiment is being carried on every year in the east of Switzerland, sometimes with good, and sometimes with evil results.

Whilst it is the business of medical societies to discuss the influence of climate on the human body; the study of the climate itself and of its various factors, which produce such powerful results, is the special province of the Meteorological Society, and it is to its accumulated experience and acquired wisdom that we must look for aid to elucidate the various remarkable phenomena of mountain climates.

Among the high altitude sanitaria of Europe, Davos at present enjoys the greatest reputation, partly on account of its easy accessibility and partly on account of certain peculiarities of position and shelter, which will presently be considered.

The valley of Davos lies in the Canton of the Grisons, between the valley of the Lower Rhine and the Upper Engadine, and has to the north of it the fertile vale of the Prättigau, a tributary of the Rhine valley, and to the south, where it expands into the Landwasser Thal, and eventually joins the Albula, it is shut in by the Piz D'Aela and the Tinzer Horn, which form picturesque features in the landscape.

The valley runs from NNE to SSW for about ten miles in length, with an average breadth of about a third of a mile; being, for the most part of this extent, a plain gently sloping towards the south, and varying in elevation from 5,400 to 4,500 feet. Davos Platz is 5,105 feet above the sea level.

The protecting mountains rise somewhat precipitously to a height of from 7,000 to 10,000 feet, and on the west side there is no break in the chain; on the east side four valleys open, one of which leads by the Fluela Pass into the Lower Engadine, but none of these penetrate the solid bulwark of mountains, which rise in the Jacob's Horn and Schwartz Horn to the height of from 8,000 to 10,000 feet, and even the Fluela Pass, at its summit, is 7,890 feet high.

The head of the valley is formed by a wooded height called the Davoser Kulm, over which the ordinary approach, namely by road from Landquart, is made. On this side the shelter is increased by the Rhaetikon range rising as a second line of defence. To the south, owing to the widening character of the valley and to the distance of the protecting mountains, it is somewhat open to winds, and from this quarter comes the Föhn or south-west wind.

The mountains immediately surrounding the valley have no glaciers, and are free from snow in summer, their sides being clad with a variety of pines. The intervening plain consists entirely of meadow land, through which a

small stream, the Landwasser, flows from the Davoser See to join the Albula river and eventually the Rhine.

In the summer, therefore, snow is hardly visible at Davos with the exception of a few patches on the more lofty and distant mountains, and the scene presents an aspect both smiling and pastoral.

The villages of Davos Platz and Davos Dörfli, distant one mile apart, lie on the western side of the valley on the slope of the Weissfluh, and thus have a plain of half a mile in width to the east.

These particulars are mentioned to enable the Fellows of the Society to appreciate the exact situation of the locality whose winter climate we will now describe.

Observations.—Mr. Arthur W. Waters, F.G.S.,* made some meteorological observations during the winter of 1870-71, using for the minimum temperatures Hermann's spirit metallic thermometer, and for the solar radiation a black bulb thermometer *in vacuo.* His minimum readings reached as low as —29°·5 C., which is a lower point than any recorded in my tables; the solar maximum did not exceed 52° C., a figure considerably below many subsequent readings.

Dr. Frankland made thermometrical observations, at Davos Dörfli, during a fortnight of the winter 1873-74, which displayed the remarkable results of the solar maximum in this climate.

During the autumn of 1876, the Rev. Francis Redford, F.M.S., then English Chaplain at Davos, brought an excellent set of instruments from Messrs. Negretti and Zambra, which had been verified at Kew, and commenced a careful set of observations at Davos Platz, in the grounds of the Hôtel Belvedere. The instruments were a maximum and minimum thermometer, a dry and wet bulb hygrometer, and a solar radiation thermometer, as well as an aneroid barometer.

Mr. Redford carried on the observations during the winters 1876-77 and 1877-78, when he quitted Davos, and during the following season they were continued, at my request, by Mr. Reginald Gunnery, B.A.

During this last season they have been taken by Mr. and Mrs. MacMorland, the latter the authoress of "Davos, by One who knows it well."

Position of Instruments.—The Stevenson Screen, containing the thermometer and hygrometer, stands 4 feet above the ground and 46 feet from the hotel, which is slightly elevated above the valley; the road leading up to the hotel runs to the south of the screen and the ground falls rapidly towards the road, so that the screen itself stands on the edge of a declivity and is very freely exposed to the air. A little in front of this is the black bulb radiation thermometer, situated somewhat close to the screen, and it is possible that from this source it receives some reflected heat.

The observations for the four seasons have been condensed into Tables I. and II., constructed on the same patterns as the excellent ones in Mr. Marriott's paper on the meteorological observations taken at Rossinières.†

* Klimatologische Notizen über den Winter im Hochgebirge.

† Quarterly Journal of Meteorological Society, Vol. III., p. 215.

Table I. contains the monthly means of the barometer, the monthly and winter means and the extremes of the thermometer and of the solar maximum thermometer, and the means of the hygrometer. It will be seen that the winter season consists of 6 months, from October to March inclusive. March 1879 is omitted through absence of the observer. On the other hand, September 1879 is added for purposes of comparison, but is not included in the winter season.

Barometer.—These observations were taken on a duly compensated aneroid barometer at 9 a.m. daily, and, unfortunately, none appear to have been made with the mercurial barometer.* They are complete for the winters 1876-7 and 1879-80; for the former the mean is 24·62 ins., and for the latter 25·02 ins.

Temperature.—Observations have been taken three times daily, viz. at 7 a.m., at 1 p.m. and at 6 p.m.

The mean temperature has been reduced from the mean of the maximum and minimum readings for each season, and is as follows:—

1876—7	...	...	...	30°·6	Fahr.
1877—8	...	...	...	28·3	,,
1878—9	...	...	...	26·3	,,
1879—80	...	...	...	27·3	,,

giving a mean of 28°·1, a very low temperature to live in. The maxima range from 75°, registered in October 1876, to 10°·2, in December 1879; the mean maximum of the four years being 39°. The minima range from 43°·1, in October 1876, down to —16°·7, in December, 1879; the mean minimum for the four years being 17°·3.

Table II. further analyses the maxima and minima, and we see that the maximum exceeded 60° Fahr. on 16 days only, in 1876-7, on but 9 days in 1878-9, and on but 8 days in 1879-80; that it fell below 20° on two days in the first winter, on 10 days in the third winter, and on 13 days in the last winter.

The minimum fell below 0° Fahr. on 7 days in 1876-7; on 11 days in each of the winters 1877-8 and 1878-9, and on 15 days in last winter; these low readings occurring during the months of December and January, the absolute minimum, viz. —16°·7 Fahr., being reached on December 9th.

* Some observations on the mercurial barometer for the winter of 1879-80 have been published in the 'Davoser Blatt.' They are taken by Herr Steffan, at 7 a.m. The means are subjoined:—

							Inches.
1879	October	..	..	..	..		24·99
	November	..	..	..	..		24·80
	December	..	..	..	..		24·92
1880	January	..	..	..	..		25·00
	February	..	..	..	..		24·80
	March	..	..	..	..		25·00
		Winter Mean		..	..		24·90

TABLE I.—Summary of Meteorological Observations taken at Davos during the Four Winters, 1876-80.

Months.	Barometer Mean (Aneroid).	Temperature. Highest.	Date.	Lowest.	Date.	Mean of Highest.	Mean of Lowest.	Mean.	Solar Radiation. Max.	Solar Radiation. Mean.	Solar Radiation. Min.	Dry Bulb. 9 a.m.	Dry Bulb. 7 p.m.	Wet Bulb. 9 a.m.	Wet Bulb. 7 p.m.	Relative Humid. 9 a.m.	Relative Humid. 7 p.m.
	Ins.	°		°		°	°	°	°	°	°	°	°	°	°	o/o	o/o
1876. October	24·92	75	5, 6	22	29	59·9	34·2	46·0	147	133·2	78	45·3	42·4	42·0	39·9	76	81
November	24·75	54	14	— 3·5	11	36·8	20·2	28·5	139·3	106·1	59	24·7	26·1	23·8	25·0	77	75
December	24·61	48	3, 31	— 3	27	39·0	18·9	28·9	143·7	109·1	39	25·1	25·7	24·0	25·1	72	86
1877. January	24·13	47·8	10	2·5	23	36·0	17·7	26·8	141	108·3	43	23·1	22·9	21·9	22·0	67	75
February	24·75	47·2	15	— 1·1	6	34·7	18·6	26·6	159·2	111·0	50	24·4	24·3	23·4	23·4	75	78
March	24·56	53·3	29	— 6·2	10	36·4	16·2	26·3	162·8	121·4	53	25·9	24·8	23·8	23·6	56	71
Winter	24·62	75	Oct. 5, 6	— 6·2	Mar. 10	40·4	20·9	30·6	162·8	114·8	39	28·0	27·7	26·4	26·5	70	72
												1 p.m.		1 p.m.		1 pm	
1877. October (11 days)	25·12	70	21	21·5	28	52·3	27·3	39·8	134	109·6	65	48·1	..	42·5	..	64	..
November	24·46	..	..	6	22	..	24·1	..	143	109·0	42	40·5	..	34·6	..	58	..
December	24·89	..	..	— 2	26	..	12·7	..	149	100·5	31	24·8	..	23·2	..	62	..
1878. January	24·78	48	22	—10	12	29·8	8·8	19·3	133	106·7	40	23·6	..	21·6	..	53	..
February	..	52·5	18	— 5	1	41·3	12·4	26·8	145	118·4	55	35·4	..	30·8	..	61	..
March	..	55	5	— 9	17	35·4	16·1	25·7	164·5	126·3	76	30·6	..	27·6	..	60	..
Winter	24·81	70	Oct. 21	—10	Jan. 12	39·7	16·9	28·3	164·5	111·4	31	33·8	..	30·0	..	63	..
1878. October	..	70·5	7	7·5	31	52·8	31·0	41·9	144	126·2	77·5	..	..	..	..	..	..
November	24·79	45	26	8	8	34·8	17·9	26·3	157·5	111·1	44	..	..	..	..	..	..
December	24·68	38·5	28	— 5	25	25·8	6·9	16·3	147	90·0	38·5	..	..	..	..	..	..
1879. January	24·84	47·5	25	— 7·5	6	33·3	10·4	21·8	141	110·7	34	..	..	..	..	..	..
February	24·60	47·5	11	8	28	35·2	15·2	25·2	166·5	129·3	57	..	..	..	..	..	..
Winter	24·72	70·5	Oct. 7	—7·5	Jan. 6	36·3	16·2	26·3	166·5	113·4	34	..	..	..	..	..	
1879. September	25·08	76·5	4	28·8	10	60·7	39·6	50·1	150·5	121·5	50·5	58·0	..	50·1	..	57	..
October	25·08	66·3	2	15	19	53·9	27·7	40·8	143	122·9	50	49·0	..	42·5	..	59	..
November	24·93	53·5	1	1	27	33·4	16·5	24·9	148	105·1	41	29·3	..	27·7	..	74	..
December	25·09	39·7	26	—16·7	9	28·6	5·5	17·0	138	108·5	43·5	24·3	..	22·1	..	51	..
1880. January	25·13	47·7	30	—12·5	20	32·2	6·7	19·4	150·5	122·1	46·5	28·9	..	24·6	..	40	..
February	24·92	46·2	21, 22	4·5	26	39·6	14·9	27·2	142·5	121·2	59	38·4	..	31·4	..	51	..
March	25·01	59	8	9·5	2	48·8	20·5	34·6	145	128·4	76	41·9	..	36·9	..	66	..
Winter	25·02	66·3	Oct. 2	—16·7	Dec. 9	39·4	15·3	27·3	150·5	118·0	41	35·3	..	30·8	..	62	..

TABLE II.

Months.	No. of Days on which the Maximum Temperature was: Below 20°.	Between 20° & 30°.	Between 30° & 40°.	Between 40° & 50.°	Between 50° & 60°.	Between 60° & 70°.	Above 70°.	Lowest Maximum.	No. of Days on which the Minimum Temperature was: Below 0°.	Between 0° & 10°.	Between 10° & 20°.	Between 20° & 30°.	Between 30° & 40°.	Between 40° & 50°.	Above 32°.	Highest Minimum.
1876. October	..	..	1	4	10	12	4	33°	..	..	..	6	21	4	20	43·1°
November	..	8	11	8	3	..	..	21	1	3	8	13	5	..	1	34·8
December	..	6	9	15	1	..	..	24·7	1	4	9	15	2	..	1	33
1877. January	..	..	7	14	10	..	..	22	..	7	8	15	1	..	..	30·4
February	1	7	13	7	..	..	..	19	1	3	13	8	3	..	..	31·1
March	1	10	5	12	3	..	..	14·0	4	5	7	12	3	..	1	32·3
Total	2	31	46	60	27	12	4	..	7	22	45	69	35	4	23	..
1877. October (11 days)		..	..	..	..	..	..	..	..	..	..	..	..	..		..
November	..	..	..	..	..	..	..	..	..	2	2	20	6	..	2	35
December	..	..	..	..	..	..	..	..	2	10	10	8	..	.	..	25
1878. January	..	10	6	2	..	..	..	21	6	11	9	5	..	..	..	26·5
February	..	1	9	16	2	..	..	25	1	5	19	3	..	..	..	26
March	..	9	9	10	2	..	..	20·5	2	7	8	12	2	..	..	30·5
1878. October	..	..	4	5	13	8	1	31·5		1	2	6	22	..	17	39·6
November		7	17	6	..	..	..	24	..	4	16	7	3	..	3	37·5
December	6	18	7	..	..	..	..	12·5	7	12	10	2	..	..	..	23
1879. January	3	10	8	10	..	..	..	..	4	10	8	8	1	..	1	35
February	1	3	19	5	..	..	..	18·2	..	6	17	4	1	..	..	31
Total	10	38	55	26	13	8	1	..	11	53	53	27	27	..	21	..
1879. October	..	1	2	4	16	8	..	29·8	..	..	4	17	10		5	34·9
November	2	9	11	7	1	..	..	16	..	8	11	7	4	..	2	36
December	10	3	18	..	..	..	..	10·2	8	8	13	2	..	..	..	25·5
1880. January	1	10	17	3	..	..	..	18·7	7	14	8	2	..	..	..	22·5
February	..	1	12	16	..	..	..	28·5	..	8	15	5	1	..	..	31·2
March	.	..	2	14	15	..	..	35·6	..	1	12	15	3	..	2	32·5
Total	13	24	62	44	32	8	..	..	15	39	63	48	18	..	9	..

Solar-radiation Thermometer.—These observations have been taken at sunset. The results are remarkable, as showing the large amount of sunshine enjoyed by the Davos valley.

The monthly means are given in the 10th column of Table I., and yield for—

1876—7	...	...	...	114·8°
1877—8	...	...	...	111·4
1878—9	...	...	...	118·4
1879—80	...	..	...	118·0

giving a mean of 114°·4.

The records of the four years range from 81° to 166°, 150° being a not uncommon temperature on a clear still day.

Dr. Frankland made the following experiment, which bears on our black

bulb thermometer observations. He placed a plain mercurial thermometer in a box lined with black cloth and with its top covered with plate glass a quarter of an inch thick, and exposed this to the sun's rays. On December 22nd, 1874, he found that the thermometer rose at 2 p.m. to 105° Cent., or 221° Fahr., that is, 9° above the boiling point at sea level and 21° above that for the Davos altitude. Dr. Frankland remarks that, "considering the rays were not concentrated, this result was extraordinary."*

The comparison I made last year between Greenwich, Cannes and Davos, brings out the solar maximum results in a striking manner.

BLACK BULB THERMOMETER *in vacuo*.

Months.	Greenwich.		Cannes.†		Davos.	
	Mean.	Max.	Mean.	Max.	Mean.	Max.
	°	°	°	°	°	°
November 1878	59·8	79·9	96·6	122·0	111·1	157·0
December 1878	48·8	61·0	86·8	105·0	90·0	147·0
January 1879	43·4	63·8	90·7	119·0	110·7	141·0
February 1879	59·4	81·4	101·0	121·0	113·6	166·5

Hygrometer.—The dry and wet bulb thermometers have been used. During the year 1876-77 the observations were taken at 9 a.m. and at 7 p.m., and the percentage of relative humidity for each month is shown in the last two columns of Table I., the averages for the season being for the 9 a.m. observations, 70 per cent., and for the 7 p.m. 72 per cent. The hour of observation was afterwards changed, and in the subsequent winters the readings were taken once daily, viz. at 1 p.m., the reason, I believe, being that this hour was considered more important to invalids than the former hours, when they would be naturally indoors. Some doubt being thrown on the value of the records for the third winter, I have purposely omitted them. The second and fourth winters yield, as might be expected from the time of observation, much drier averages—the percentages of relative humidity being 63 and 62 respectively. The average temperature of the dry bulb for the last winter was 35°·3, for the wet bulb 30°·8; the average percentage for relative humidity last January was 40.

Rain and Snow.—No records appear to have been kept of the amount of rainfall, but the number of days on which rain or snow fell, or which were either fine or cloudy, were registered and are given in Table III.

As may be concluded from the temperatures given, but little moisture fell in the form of rain, and nearly the whole was precipitated as snow.

Nobody appears afraid of a snowstorm at Davos, and invalids are seen

* Proceedings of the Royal Society, Vol. XXII. p. 319.

† These observations were kindly supplied by one of our Fellows, Dr. Marcet, F.R.S.

TABLE III.

Season.		No. of Days.		
		Fine.	Cloudy.	Rain or Snow.
1876.	October	20	7	4
	November	10	8	12
	December	15	8	8
1877.	January	14	8	9
	February	7	10	11
	March	12	6	13
	Total	78	47	57
1877.	October (11 days)	7	..	4
	November	15	5	10
	December	9	10	12
1878.	January	14	7	10
	February	16	7	5
	March	5	10	16
	Total	66	39	57
1879.	October	22	2	7
	November	7	9	14
	December	20	6	5
1880.	January	22	4	5
	February	17	6	6
	March	22	3	6
	Total	110	30	43

walking about with impunity, partly because from the absence of wind the flakes fall perpendicularly, and partly because from the dryness and low temperature they do not melt on touching the clothes and are easily shaken off.

The question arises here on how many days can an invalid go out during a Davos winter? This is difficult to determine by figures alone, as so much depends on the individual's sensitiveness, but, from inquiries I have made, I believe that in a bad winter about $\frac{2}{3}$rds of the days may be counted on for outdoor exercise, and in a good winter, like the last, nearly $\frac{7}{8}$ths. One patient of mine, a lady, told me that she went out every day last winter without suffering any harm, and a very sensitive consumptive, who had spent winters in the South of France and Egypt, stated to me that he calculated that he had been kept in the house five days in each month during the winter.

Winds.—Table IV. gives the principal winds and their respective prevalence; but it unfortunately only extends over two winters and a part of a third, and no note seems to have been made of the force of the wind, an important element. All observers agree, however, that the wind force is slight, owing to the protected character of the valley. The most frequent winds are the N, NE and SW and, while the first two are scarcely felt, the Föhn or SW wind is dreaded, on account of the change it brings about in the weather.

It is accompanied frequently by a rise in temperature of some degrees, and if it prevail on several successive days, snow melting follows.

TABLE IV.—Winds at Davos.

Months.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
1876. October	1	7	13	0	4	4	1	2
November	19	5	5	0	1	1	0	0
December	6	2	1	2	3	18	1	0
1877. January	12	7	4	0	1	11	3	0
February	11	10	2	1	2	1	0	0
March	16	8	0	1	0	5	2	1
Total	65	39	25	4	11	40	7	3
1877. October (11 days)	0	0	0	0	2	5	3	0
November	8	0	0	0	9	6	6	1
December	11	0	0	3	2	1	8	6
1878. January	16	2	0	0	0	7	1	3
February	9	1	0	0	6	12	0	0
March	23	0	0	0	0	8	0	0
Total	67	3	0	3	19	39	18	10
1878. December	10	4	0	1	6	5	4	3
1879. January	15	1	0	0	6	9	2	0
February	13	2	0	0	3	12	4	3
Total	38	7	0	1	15	26	10	6

In the above Table the slightest current has been noted; but the great feature of the climate is the marked stillness of the atmosphere, and were it not for this it would hardly be possible for very delicate people to endure the extreme degrees of cold which prevail.

No amount of figures, however, will enable the Fellows to realise the conditions of the Alpine winter climate like a personal visit to Davos; and it was with this object that I travelled there for the third time in December 1878, arriving from Landquart by sledge in a snowstorm. The next day, between 9 and 10 a.m., I witnessed a splendid sunrise over the snow-clad valley, with its beautiful succession of tints reminding one of similar phenomena seen during glacier expeditions in summer. A slight mist which hung over the valley dissolved, and soon after I ascended the Schätz Alp, the hill to the west of Davos. The snow lay about three feet deep, but the walks had been swept and the seats cleared for visitors. The sky was deep blue, the air still and the sun shining brightly, and the reflection of the snow crystals made neutral tint spectacles, which are generally worn, desirable. I found that I could soon leave off my overcoat, and after awhile I tried the experiment of sitting down. This was comfortable enough, provided the feet were kept off the snow—which otherwise chilled them—on footboards, such as are provided by the Kur-Verein.

On my return home I found the invalids in numbers either walking about with parasols and spectacles, or sitting in the covered balconies, which are

built exposed to the south, enjoying the sunshine, and showing its influence in their browned faces, while some were driving in sledges, and the hardier ones skated on the frozen ponds, or occupied themselves in the Canadian amusement of "toboginning." Nevertheless, that day the maximum in the shade was only 24°, the minimum was —4°, the solar maximum being 133°.

To show how completely the heat is dependent on the direct rays of the sun, and how little on the state of the atmosphere, Mrs. MacMorland mentions that if on a typical sunny day a walker turns his back to the sun, his breath immediately forms a frozen incrustation on his moustache and beard!

The sunset was as beautiful as the sunrise, and it seemed to me that these phenomena must make up to some extent for the monotony of the scene—the dark blue sky and bright sunshine and the extent of snow. After dark I took another stroll, and though the thermometer was—2°, I managed to keep warm, as there was no wind. The houses are so thickly built with double windows, and so well lined with a wainscot of wood and warmed with German stoves, that people do not feel the cold much indoors.

The winter season commences about the middle of October, when the snow begins to fall: the valley becomes dazzling white, and the waterfalls are converted into bluish stalactites of ice. The air is crisp and exhilarating; and this state of things continues, with few breaks, till the month of April, when the snow melting, the roads become slushy and the atmosphere so damp that it is considered desirable for invalids to quit the mountains and betake themselves elsewhere till the 1st of June, when the summer season begins.

I am fully aware that the above observations are incomplete, but they are accurate as far as they go, and give, I hope, a general idea of the climate of an Alpine High Level Sanitarium in winter; and I trust that, with additional instruments, such as, for instance, a good mercurial barometer and a rain gauge, next year's observations may be rendered more complete.

The peculiar effects of the Davos winter climate seem to me to depend on the following conditions:—1. The rarefaction of the atmosphere. 2. Its dryness. 3. The absence of strong currents, owing partly to shelter and partly to the uniform layer of snow spread around. 4. The large percentage of the direct solar rays reaching the locality owing to rarefaction of the air, and also the considerable amount of heat reflected from the extensive snow plain in front of the village of Davos Platz.

My best thanks are due to Dr. Ruedi, of Davos, for furnishing some of the data of this paper, and to Mr. Marriott for several hints in the arrangement of the tables.

PROCEEDINGS AT THE MEETINGS OF THE SOCIETY.

May 19th, 1880.

Ordinary Meeting.

George James Symons, F.R.S., President, in the Chair.

Thomas Hunt Edmonds, Bridgetown, Totnes;
Francis Ekless, Woolston Lodge, Woolston, Southampton;

A. HENRY TAYLOR, 5 Clifton Crescent, Folkestone; and
THOMAS TURNER, J.P., Cullompton,
were balloted for and duly elected Fellows of the Society.

The following Papers were read:—

"Variations in the Barometric Weight of the Lower Atmospheric Strata in India." By Prof. E. DOUGLAS ARCHIBALD, M.A., F.M.S. (p. 169.)

"A Sketch of the Winds and Weather experienced in the North Atlantic between latitudes 30° N. and 50° N. during February and March 1880." By CHARLES HARDING, F.M.S. (p. 142.)

"On the Meteorology of Mozufferpore, Tirhoot, for the year 1879." By CHARLES N. PEARSON, F.M.S. (p. 182.)

Mr. D. WINSTANLEY exhibited and described his Solar Radiograph.

JUNE 16th, 1880.

Ordinary Meeting.

GEORGE JAMES SYMONS, F.R.S., President, in the Chair.

FREDERICK W. BARRY, B.Sc., M.D., C.M., F.S.S., Nicosia, Cyprus;
ARTHUR WILLIAM MARTIN, 21 Alderley Street, Cape Town; and
CUTHBERT E. PEEK, Wimbledon,
were balloted for and duly elected Fellows of the Society.

SENOR ANTONIO AGUILAR, Real Observatorio, Madrid; and
Dr. H. HILDEBRAND HILDEBRANDSSON, Observatory, Upsala,
were balloted for and duly elected Honorary Members of the Society.

The following Papers were read:—

"Ozone in Nature, its Relations, Sources, and Influences, &c." By JOHN MULVANY, M.D., R.N. (p. 184.)

"The Average Height of the Barometer in London." By HENRY STORKS EATON, M.A., F.M.S. (p. 191.)

Notes on a Waterspout observed by Lieut. A. CARPENTER, F.M.S., H.M.S. 'Sparrowhawk,' March 23rd, 1880, at Morant Cays, SE of Jamaica, at a distance of 300 yards.

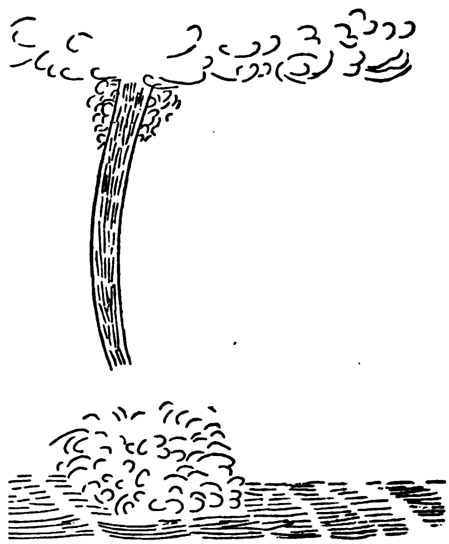
Surface of Water.—The approximate diameter of the area of disturbance was 25 yards; from it appeared a revolving drum of steam which scattered at a height of 40 feet. The water in the vicinity was not disturbed.

Spout—The tube of the spout was regular, with a dark centre, as if hollow, and edges light, as if thick, giving it the appearance of a hollow tube of steam just condensed, the whole tube being in texture that of steam just after issuing from a pipe before turning quite white. Rapid sinuous waves occasionally ran about the upper portion. The lower end of the tube appeared to reach rather more than half way down to the sea from the cloud above.

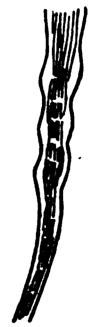
The edges of the spout were perfectly regular, except at its junction with the cloud, where they were woolly.

Revolution.—It was impossible to say with certainty which way it was revolving. The revolution of the steam was obvious, but its direction uncertain. The revolution of the tube was not certain, but there was evidently rapid movement of *particles* in revolution.

Clouds.—Nimbus, with tendency to cumulus. A little cumulo-stratus about. Upper clouds, *nil.*



Rough Sketch of Waterspout.



Double Sinuous Form.

rometer was not affected at the time, but stood a little below its average ring the day. Time of phenomenon 7 a.m.

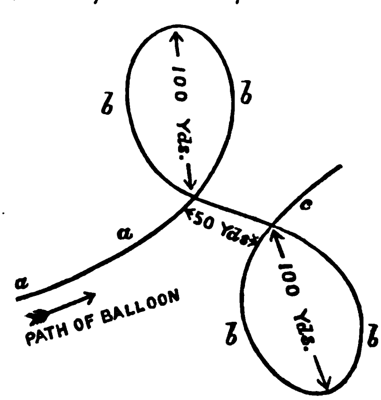
clear calm day, with heavy clouds in the morning (from which the ned) and very hot in the afternoon.

ys of sunshine were very marked all day.

OYNBEE remarked that Capt. T. W. Freeman, of the S.S. 'Nestor,' his log :—February 16th, 1880, 3° 39′ N, 100° 22′ E, "10·30 a.m.—Saw cent waterspout close to the ship. I could plainly see the water running ntral vortex in innumerable parallel lines, while the outside of the med to be formed of a network of lace. It lasted about 10 minutes. lwind on the water reminded me of a St. Catherine's wheel." The S, force 1, at 8 a.m., and ESE, force 1, at noon ; at 10 a.m. there was a ower.

of a Balloon Ascent from Lewes on March 23rd, 1880. By Captain J. PLER, R.M.R., and Captain H. ELSDALE, R.E.

cent was made in the balloon 'Crusader,' of about 25,000 cubic feet at 2·10 p.m., with an excellent gas, lifting 56lb. per 1,000 t. The ground current at as variable ; general direction W ; pressure about ½lb. per ot ; rate 14 miles an hour. an elevation of 300 up to the current was nearly W ; it veered in a more northerly and above 1,500 feet it was



about 7 miles from Lewes, and Wood, the balloon, then at) feet, began to diverge from e in a remarkable manner. companying sketch represents ital plan of the path of the a, a being her proper course

in approaching the wood, due to the then prevailing current, and *b*, *b*, *b* her subsequent path.

The balloon described, as will be seen, two considerable loops in her horizontal course. During this time her behaviour, viewed in a vertical plane, was extraordinary and unprecedented. After flapping for a few moments, as if suddenly caught between opposite currents, she ran down upon the wood below, in a manner suggestive of a whirlpool of air. It was necessary to throw out great quantities of ballast to check her descent and keep her off the trees. When at last checked in her downward course, and close to the ground, she rose rapidly with the strong ascending force due to the loss of about 150lbs. of ballast. It was then necessary to let out gas by opening the valve, to prevent an upward run, which would have carried the balloon to a dangerous height.

Hardly had an approximate equilibrium been again established, at an elevation of about 1,000 feet, when the same conditions occurred again, the balloon running so rapidly down upon the wood that we were among the trees before we stopped her descent. After this process had been two or three times repeated, and the balloon had arrived for the second time at the point marked *c* in plan, we thought it best to haul her down among the trees for shelter. This was done with the assistance of some woodcutters who were on the spot.

We then towed the balloon captive out of the wood by the aid of two ropes. This operation was attended with much difficulty owing to the fitful and variable character of the wind, and the balloon at one point was beaten down into the trees for a time; whilst elsewhere we found it advisable to keep her close to the ground under the shelter of the trees, to await the subsidence of the blast. Small boughs were whirled about in the wood at times, when the gusts were strong.

Captain Elsdale ascended again about a quarter of an hour later alone, from a point just outside the wood. Neither he nor Captain Templer, who observed the course of the balloon from the ground, then noticed anything irregular or unusual. The currents had however veered a little, so as to carry the balloon more easterly than at first.

DISCUSSION.

Capt. TEMPLER said that the woodcutters who helped them to secure the balloon, verified what had taken place, and he had also seen several boughs blown off the trees.

Mr. SCOTT said that the fact of the balloon being driven down when it came within the influence of the whirlwind would doubtless be held by M. Faye and others to afford strong evidence of the descent of the air in cyclones in general.

The PRESIDENT (Mr. Symons) inquired whether it was simply twigs or branches that were blown off the trees; and, if the latter, the greatest thickness which was noticed to have been broken through?

Capt. TEMPLER said the branches were about the size of a man's arm.

"Results of Meteorological Observations made at Stanley, Falkland Islands, 1875-77." By WILLIAM MARRIOTT, F.M.S., Assistant Secretary. (p. 199.)

"A New Thermograph." By WILLIAM DAVID BOWKETT.

The portion of the instrument directly influenced by variation of temperature consists of a flattened metallic tube (Bourdon's pressure gauge tube) bent into a semicircle. This tube is completely filled with linseed oil, and hermetically sealed. One end of the tube is fixed to the bed plate of the instrument; the other, or free end, is connected by a short link to a simple lever movement, which multiplies the first movement about 2½ times.

The long arm of this lever traverses radially the recording surface, a paper disc. This disc is divided by concentric circles into degrees, and by radii into hours and their sub-divisions. The disc is caused to rotate by means of ordinary clockwork once in twelve hours.

Any variation of temperature to which the instrument is subjected will

produce a variation in the pressure exerted by the liquid within the curved tube, causing a proportionate alteration in its curvature. The movement thus produced, being communicated to the lever, causes the end of the long arm to approach or recede from the centre of the rotating disc; and in doing this a line is traced (by the pen carried at the extremity of the lever) whose relation to the concentric circles marks the temperature, and to the radii, marks the times of occurrence of those temperatures.

Each circle corresponds to 5° F., commencing with zero at the circumference, and terminating at 80° near the centre.

Owing to the comparative incompressibility of liquids, the tube is not appreciably affected by barometrical changes.

The instrument is fairly accurate, and can be made much more so, its errors being caused by the slight friction of the working parts; but the chief merits claimed for it are portability and economy in construction.

DISCUSSION.

Mr. B. LATHAM thought that the thermograph would be affected by atmospheric pressure.

Mr. BOWKETT said that he had tried the instrument under an air-pump and had not found it to be appreciably affected by variations of pressure. Of course it must be affected to some extent, but owing to the incompressible nature of liquids, the error, theoretically, would not exceed, with the ordinary barometrical variations, one-thirtieth of a degree Fahrenheit.

Mr. ELLIS said that he had tried the thermograph in a room in which the range of temperature had been about 15° during the time of trial, and had found that the thermograph indications agreed very fairly with those of an ordinary thermometer.

The PRESIDENT (Mr. Symons) said that thermographs on this principle were in use at the Montsouris Observatory, Paris. He thought it would be much better if the cards, instead of being circular, were rectilinear.

"The Winter Climate of Davos." By CHARLES THEODORE WILLIAMS, M.A., M.D., F.M.S. (p. 203.)

RECENT PUBLICATIONS.

AIDS TO THE STUDY AND FORECAST OF WEATHER. By W. CLEMENT LEY, M.A. Published by authority of the Meteorological Council. 88 pp. 8vo. 1880.

The object of this manual is to facilitate the study of weather to persons who are in a position to avail themselves of the usual meteorological instruments, and who wish to bring their own local observations into connection with the more general information supplied by the Daily Weather Reports of the Meteorological Office. The work is divided into three chapters, as follows:—I. Observations: Wind, Clouds, Weather Signs. II. Relations of Pressure and Wind: General Laws, Distribution of Mean Pressure and Prevalent Winds over the Globe, Irregular fluctuations of Pressure, Cyclonic and Anticyclonic Systems, Theory of Cyclonic Systems. III. Characteristic Types of Weather: Special Relations of Weather to Cyclonic Systems, Special Relations of Weather to Anticyclonic Systems, Specimens of Forecasts.

ANNUAIRE DE LA SOCIÉTÉ MÉTÉOROLOGIQUE DE FRANCE. Tome XXVII. 1879. Bulletin des Séances, feuilles 14-38. 4to.

Principal contents:—Le verglas du 22 janvier 1879, par M. de Tastes.—De la nébulosité du ciel en Europe. Courbes isonèphes, par E. Renou.—Composition de l'atmosphère et de ses rapports avec la végétation, par E. Renou.—Recherches sur le climat des établissements français de la côte septentrionale du golfe de Guinée, par Dr. A. Borius.—Résumé des observations centralisées par le Service

hydrométrique du bassin de la Seine, pendant l'année 1878, par G. Lemoine.—Sur la distribution relative des températures et des pressions moyennes en janvier et juillet, par L. Teisserenc de Bort.—Etude météorologique de l'île de Kerguelen, par R. P. Perry, S.J.

CHRISTIANIA VIDENSKABS—SELSKABS FORHANDLINGER. 1880. No. 6. 8vo.

Contains :—Iagttagelser over Nordlys anstillede i Norge, Sverige og Danmark. Samlede og bearbeidede af Sophus Tromholt (pp. 148 and 5 plates). This is a discussion of the observations of the Aurora Borealis as recorded at 132 Stations in Norway, Sweden, and Denmark, from September, 1878, to April, 1879.

CIEL ET TERRE. REVUE POPULAIRE D'ASTRONOMIE ET DE MÉTÉOROLOGIE. Nos. 11-16. August-October, 1880. 8vo.

The chief meteorological articles are :—Traité élémentaire de Météorologie, par J. C. Houzeau et A. Lancaster.—L'Ozone, par J. Vincent.

JOURNAL OF THE ASIATIC SOCIETY OF BENGAL. Vol. XLIX. Part II. 1880. 8vo.

Contains :—The High Atmospheric Pressure of 1876-8 in Asia and Australia in relation to the Sun-spot Cycle, by H. F. Blanford.

JOURNAL OF THE SCOTTISH METEOROLOGICAL SOCIETY. New Series. Vol. V. Nos. LX.-LXIII. 8vo. 1880.

Contains :—The diurnal periods of Thunderstorms in Scotland, by A. Buchan. —Meteorological observations at San Jorge, Central Uruguay, in 1867-68, by D. Christison, M.D.—Pamperos and their relation to the other Storms of Uruguay and Buenos Ayres, by D. Christison, M.D.—Report on Simultaneous Observations of the force of Wind at different heights above the ground, by T. Stevenson. —Mean Temperature of Thorshavn, Faröe, by Dr. E. Madsen and A. Buchan.—Monthly Mean Temperature of Arbroath for the 37 years 1843-79, by A. Brown, LL.D.—The Tay Bridge Storm of 28th December, 1879, by A. Buchan.—The influence of the Fog of November, 1879, to February, 1880, on the health of London, by A. Mitchell, M.D.

NAUTICAL MAGAZINE. September, 1880. 8vo.

Contains :—The Law of Storms and the Heaving-to Tack, by J. K. Laughton.

OBSERVATIONS MADE AT THE MAGNETICAL AND METEOROLOGICAL OBSERVATORY AT BATAVIA. Published by order of the Government of Netherlands India. Vol. IV. Folio. 1879.

This contains the hourly meteorological observations made at the Batavia Observatory during the three years 1876-78; also the mean results for the thirteen years 1866-78.

ON THE STORMS OF THE CHINESE SEAS, AND ON THE STORM OF THE 19TH AND 20TH MARCH, 1880. By R. F. M. DECHEVRENS, S.J., Director of the Zi-Ka-Wei Observatory. 4to. 1880.

The subjects dealt with in this Paper are :—The Storms of the North Atlantic, and the Storms of the Chinese Seas: Atmospheric depressions in China and Japan; and the Storm of March 19th, 1880. The author remarks that typhoons move with less rapidity than common storms, and instances how slow the typhoon of July 31st, 1879, was in its beginning, the wind was terrific, but the centre only moved at the rate of 5 miles an hour, and its greatest speed seemed not to have exceeded 30 miles per hour. Their direction also is quite different from that of ordinary atmospheric depressions. These move from west to east; whereas typhoons travel rather from south to north, with a deviation first to the west, and afterwards to the east, on coming into those latitudes. Thus they appear everywhere to follow the general direction of the upper anti-trade winds, whose course describes an enormous parabola, the concavity of which looks towards the east, and whose vertex usually lies about the Tropics.

PROGRAMME DE L'UNIVERSITÉ POUR LE 2E SEMESTRE, 1880. Christiania. 4to.

Contains :—Etudes sur les mouvements de l'Atmosphère, par Prof. C. M. Guldberg et Prof. H. Mohn. Deuxième partie.

PUBBLICAZIONI DEL REALE OSSERVATORIO DI BRERA IN MILANO. No. XVI. 4to. 1880. 90 pp.

Contains :—Sui Temporali osservati nell' Italia Superiore durante l' anno 1877. Relazione di G. Schiaparelli e P. Frisiani.

TRANSACTIONS AND PROCEEDINGS OF THE ROYAL SOCIETY OF VICTORIA. Vol. XVI. 8vo. 1880.

Contains :—On the Relation between Forest Lands and Climate in Victoria, by R. L. J. Ellery, F.R S. From the facts set forth the author thinks it will be conceded that forests play a most important part in climate ; that without them, while the rainfall might not diminish, it would become more fitful, and the country more and more exposed to extremes of temperature, the winds drier, and the soil more arid and sterile. Moderate forest clearing in very humid climates is doubtless beneficial, and many tropical regions have been rendered habitable and healthy by the process ; but in a dry climate, like that of Southern Australia, the indiscriminate clearing of timbered lands invites an ever-increasing aridity of climate and diminishing fertility of the soil.

ZEITSCHRIFT DER ÖSTERREICHISCHEN GESELLSCHAFT FÜR METEOROLOGIE. Redigirt von Dr. J. HANN. XV. Band. August-October, 1880. 8vo.

Contains :—Der Thalwind des Ober-Engadin, von R. Billwiller.—Die Nilwasserstände bei den Barrages, von Prof. H. Fritz.—Bemerkungen zu der Abhandlung des Herrn Eliot über die Madras Cyklone, 1877, von Dr. J. Hann.—Regenhäufigkeit und Regendauer, von Dr. W. Köppen.—Von den magnetischen Verhältnissen in den arktischen Gegenden, von Dr. A. Wijkander.—Erläuterung einiger Punkte einer früheren Abhandlung über die Variationen des Luftdruckes und der Temperatur während eines Sonnenflecken-Cyclus, von H. F. Blanford, F.R.S.

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THE END.

REPORT

ON THE

METEOROLOGY OF ENGLAND

FOR THE YEAR

1880,

WITH

MONTHLY AND YEARLY ABSTRACTS OF OBSERVATIONS
MADE AT THE SECOND ORDER AND CLIMATOLOGICAL STATIONS

OF THE

METEOROLOGICAL SOCIETY.

BY

WILLIAM MARRIOTT, F. M. S.,

Assistant-Secretary.

ERRATA.

CHESTER ...	March	Rainfall, *for* 0·65 in.	*read*	1·16 in.
CRANLEIGH ...	June	„ „ 2·96 in.	„	2·64 in.
„ ...	„	No. of rainy days 18	„	16
CROMER ...	February	Rainfall, *for* 1·16 in.	„	1·20 in.
Harestock ...	January	„ „ 0·22 in.	„	0·32 in.
„ ...	„	No. of rainy days 2	„	3
HODSOCK ...	July	Rainfall, *for* 5·24 in.	„	5·27 in.
ISLEWORTH ...	January	„ „ 0·48 in.	„	0·43 in.
TORQUAY, C.C.	April	„ „ 1·88 in.	„	1·89 in.
„	„	No. of rainy days 17	„	18
„	July	Rainfall, *for* 2·31 in.	„	2·32 in.
„	„	No. of rainy days 20	„	21
TUNBRIDGE WELLS	„	Mean temperature 50°·7	*read*	60°·7
VENTNOR ...	June	Rainfall, *for* 2·08 in.	*read*	2·02 in.
„ ...	August	„ „ 0·71 in.	„	0·70 in.

RAMSGATE.—The following figures should be substituted for those already rinted :—

	Rainfall.	Greatest fall.	Date.	No. of days.
January	·22 in.	·08 in.	22	4
February ...	1·73	·63	16	14
March	·27	·10	2	5
April	1·53	·57	15	10
May	·38	·23	31	5
June	4·32	1·05	25	14
July	2·35	·53	25	17
August	2·29	1·07	24	7
September ...	2·56	·71	14	11

Report on the Meteorology of England for the Quarter ending MARCH 31ST, 1880, *with Monthly Abstracts of Observations made at the Society's Second Order and Climatological Stations.* By WILLIAM MARRIOTT, Assistant-Secretary.

ATMOSPHERIC PRESSURE was above the average.

In *January* the mean pressure, reduced to sea-level, was 30·37 ins. The highest readings were in the south-east, and the lowest in the north. The maximum occurred in the east on the 7th, and in the other districts generally on the 20th or 21st; the highest being 30·690 ins. at Ramsgate at 9 a.m. on the 7th. The minimum took place at all stations on the morning of the 1st, the lowest being 29·527 ins. at Scaleby.

In *February* the pressure was much lower, and subject to greater oscillation than in the preceding month; the mean was 29·76 ins. The highest readings were in the south-east and south, and the lowest in the north and north-west. The maximum occurred in the south-east on the morning of the 3rd, in the north on the evening of the 24th, and in the south-west on the morning of the 25th; the highest being 30·523 ins. at Babbacombe on the 25th. The minimum took place in the west and north on the 16th, and in the south-east on the morning of the 17th; the lowest being 28·434 ins. at 1 p.m. on the 16th at Carmarthen.

In *March* the pressure was in excess of, and much more uniform than, that of the previous month; the mean being 30·11 ins. The distribution of pressure varied but slightly over the country; the highest readings, however, were in the south-east and east, and the lowest in the north and west. The maximum occurred at all stations on the morning of the 8th, the highest being 30·577 ins. at Wakefield. The minimum took place in the west on the morning of the 3rd, and in the south on the morning of the 31st, the lowest being 28·885 ins. at 9 p.m. on the 2nd at Scaleby.

AIR TEMPERATURE was a little below the average.

In *January* the mean temperature was 33°·4, and varied from 38°·6 at Llandudno, and 36°·9 at Scarborough, to 30°·7 at Marlborough, and 31°·3 at Strathfield Turgiss. The weather was fine, dry, and cold, especially from the 18th to the 29th. The maximum occurred generally on the 1st, and at a few places on the 31st, the highest being 58°·3 at Shrewsbury on the 1st, and 59°·4 at Teignmouth on the 31st. The minimum temperature took place chiefly on the 20th, 27th, 28th, and 29th, the lowest being 1°·0 at Alston on the 20th, and 8°·6 at Marlborough on the 28th. The mean daily range of temperature was 9°·7.

In *February* the mean temperature was 41°·1, and varied from 44°·6 at Llandudno, and 43°·6 at Babbacombe, to 38°·5 at Buxton, and 39°·0 at Kelstern. The weather throughout the month was mild, wet, and squally. The maximum temperature occurred on various dates, the highest being 57°·6 at Aspley Guise and 56°·6 at Wakefield on the 1st, and 57°·3 at Teignmouth on the 21st. The minimum temperature took place chiefly on the 1st, 5th, 6th, 9th, and 25th; the lowest being 21°·6 at Strathfield

Turgiss on the 1st, and 22°·1 at Alston on the 9th. The mean daily range was 11·0.

In *March* the mean temperature was 42°·1, and varied from 45°·2 at Babbacombe, and 45°·1 at Carmarthen, to 39°·2 at Buxton. The weather was very fine, dry, and mild. The maximum temperature occurred on the 25th, 29th, or 30th, the highest being 65°·1 at Southampton on the 26th, and 64°·6 on the 30th at Strathfield Turgiss. The minimum temperature took place on the 20th, 24th, and 29th, the lowest being 19°·9 at Throcking on the 20th, 18°·7 at Alston on the 22nd and 24th. The mean daily range was 14°·6.

Rainfall was much below the average.

In *January* the rainfall and number of rainy days were very small at all stations. The monthly falls varied from 2·55 ins. at Dartmoor, and 1·34 in. at Cockermouth, to 0·06 in. at Lowestoft, and 0·17 in. at Churchstoke and Kelstern. At Harestock, near Winchester, rain fell on two days only. The greatest daily falls occurred mostly on the 1st, 16th, and 22nd, the largest being 1·25 in. at Dartmoor on the 21st. Snow fell at many places from the 13th to the 18th.

In *February* both the rainfall and number of rainy days were large, especially in the south-west. The monthly falls varied from 11·60 ins. at Dartmoor, and 6·45 ins. at Buxton, to 1·62 in. at Scarborough, and 1·73 in. at Ramsgate. The greatest daily falls occurred mostly on the 15th, 16th, and 18th, the heaviest being 1·75 in. at Dartmoor on the 15th.

In *March* the rainfall was greatest in the north and west, and least in the east and south. The monthly falls varied from 5·95 ins. at Dartmoor, and 3·80 ins. at Buxton, to 0·20 in. at Ramsgate, and 0·39 in. at Norwood. The greatest daily falls took place mostly on the 2nd and 31st, the heaviest being 2·33 ins. at Dartmoor, and 1·68 in. at Buxton on the 2nd. Snow and hail fell in the west on the 1st, and thunderstorms occurred at a few places on the 3rd and 10th.

Fog was prevalent all over the country on many occasions in January and March. The fog was especially dense and persistent in London from January 26th to February 3rd.

Wind.—In *January* SW winds prevailed from the 1st to the 6th, E and NE from the 7th to the 26th, and S or SW to the end of the month. A gale occurred at some of the stations on the 1st. Calms and variable airs were reported from several places. In *February* the wind was squally, and chiefly from the SW. Gales and strong winds were experienced on several occasions. In *March* SW winds blew generally from the 1st to the 7th, and on the 31st, while E winds prevailed from the 8th to the 30th. Severe gales were felt at several places on the 1st and 2nd.

Notes by the Observers.

Babbacombe, *January*.—This has been another dry, cold month. No rain fell after the 17th. It was the 15th consecutively cold month since November,

1878. The temperature was remarkably equable from the 23rd to the 25th, only ranging 3°·3 in the 3 days. The weather was generally very dull, gloomy, and misty. In the 8 days from the 5th to the 12th no sun was visible.

February.—The month has been mild, wet and stormy, with great variations of the barometer. The mean temperature was 6°·9 warmer than that of January; and was the first occurrence of monthly temperature above the average since October, 1878. On the 16th a severe SSE to SW gale blew, reaching a velocity of 59 miles in the hour from noon to 1 p.m., the direction being SSW. Vegetation is backward.

March.—It has been a mild, damp month. The weather was warm and wet, with SW winds and low barometer in the first week, and on the 31st; but generally dry with E winds and high barometer from the 7th to the 29th. Fog was unusually prevalent in the second week. A violent and prolonged WSW gale blew on the 2nd and 3rd, exceeding a velocity of 50 miles in each of the 8 consecutive hours from 6 p.m. on the 2nd to 2 a.m. on the 3rd.

Cheltenham, *January.*—A remarkably dry and calm month; generally cloudy, with exceptions at the end of month, when though the wind was from the S the days were beautifully bright. Fogs were common during the frost, and the hoar-frost was very beautiful.

February.—Atmospheric pressure very variable, accompanied by heavy storms of rain and wind; heavy rain during the chief part of the month.

March.—A very dry month, with steady barometric pressure; light winds.

Croydon, *January.*—This was remarkable as being the 15th unseasonably cold and the 4th very dry month in succession, for a severe frost at its close, which, being unaccompanied by snow, penetrated the ground to a very unusual depth, and for the high pressures so frequently indicated by the barometer. Many tea-scented roses, although well protected with hay, have been much injured. Total fall of rain smaller than in any January in Croydon for at least 20 years. Duration of bright sunshine recorded 47 hours.

February.—This was the first warm month since October 1878, and the first wet one since September last. Barometer was low and variable. Throughout the whole of the last 12 days of January and the first week in this month, or for nearly 3 weeks, the temperature of the soil at 1 foot remained within 2° of the freezing point. Total duration of recorded sunshine 62·6 hours.

March.—On the 25th the air temperature rose 35° and afterwards fell 32°. A peach on a S wall came into flower on the 15th, or nearly a month earlier than last year, and a *Pyrus japonica* on an E wall on the 20th, or 11 days earlier. On the 2nd the total velocity of the wind was 684 miles and the highest velocity in any 1 hour 33 miles—direction WSW. North-easterly and easterly winds prevailed for 396 hours, or 16½ days.

Dartmoor, *January* 13th.—Six inches of snow measured this morning.

Hillington, *January.*—The first 4 days and some in the latter part very fine. Mist prevailed to an exceptional degree. The driest January for many years past, the rainfall being 1·79 in. below the mean of 14 years.

February.—Altogether a mild and pleasant month, with fog at the beginning and wind in the latter part. Rainfall 0·23 in. above the mean of 14 years.

March.—A fair amount of sun, with overcast mornings and evenings; more fog than usual. The rainfall 0·24 in. less than the mean of 14 years.

LOWESTOFT, *February.*—This has been a fine, seasonable month, very valuable to the farmer for his agricultural operations.

MANSFIELD, *January.*—This has been a remarkably fine month. With the exception of a little fog in the evening and morning occasionally, there was a remarkable freedom from the dense fogs that have occurred elsewhere.

SCARBOROUGH, *January.*—The month has been remarkable for high barometer readings, and the smallness of the rainfall. The average rainfall for this month during the preceding 14 years being 2·01 ins., there is consequently a deficiency of 1·67 in., and in no instance in the above period has the January fall been so small, representing, as it does, only about one-sixth of the usual supply. The mean temperature of the air was 1°·8 below the previous 12 years' average. The sea temperature at one fathom below the surface was 39°·8, or about 2° colder than the average of the previous 8 years.

February.—The average height of the barometer has been 0·64 in. lower than that of the previous month, while the average temperature was 2°·4 above that of the preceding 12 years, and 6°·0 milder than the corresponding month last year. The rainfall was 0·03 in. less than the February average of the previous 14 years. The mean sea temperature was 40°·2.

March.—The month commenced with rain and strong westerly winds, but after the first few days the weather became more settled, and the usual dry, cool, easterly spring winds prevailed up to the end. The barometer was high and steady during last three weeks. The mean temperature was 0°·7 and the rainfall 0·15 in. above the average; the number of rainy days, however, being less by 4½. Average sea temperature was 42°·8.

SOUTH-BOURNE-ON-SEA.—The total duration of sunshine was in January 57·30 hours, February 72·60 hours, March 168·95 hours.

ERRATA.

DARTMOOR—*September* 1879—Rainfall, for 8·09 ins. read 9·42 ins.
„ „ Greatest fall, for 1·21 in. on 28th read 1·33 in. on 6th.
„ „ No. of rainy days, for 16 read 17.
Yearly Table 1879—Rainfall, for 86·53 ins. read 87·86 ins.
„ „ No. of rainy days, for 227 read 228.

List of Second Order Stations, with the Names of the Observers, &c.

Station.	County.	Lat.	Long.	Above Sea.	Observer.
Babbacombe	Devon	50°29′N.	3°31′ W.	293	E. E. Glyde, F.M.S.
Buxton	Derby	53 14	1 54 W.	987	E. J. Sykes, F.R.A.S., F.M.S.
Carmarthen	Carmarthen	51 52	4 18 W.	188	G. J. Hearder, M.D.
Cheadle	Stafford	52 58	1 57 W.	646	J. C. Philips, J.P., F.M.S.
Cheltenham	Gloucester	51 54	2 3 W.	184	R. Tyrer, B.A., F M.S.
Churchstoke	Montgomery	52 31	3 5 W.	549	P. Wright, F.C.S., F.M.S.
Croydon (Addiscombe)	Surrey	51 23	0 4 W.	201	E. Mawley, F.M.S.
Dartmoor (Prince Town)	Devon	50 33	3 59 W.	1350	W. H. Tooker.
Downside	Somerset	51 15	2 29 W.	592	Rev. T. L. Almond, O.S.B., F.M.S.
Hillington	Norfolk	52 48	0 33 E.	88	Rev. H. E. B. Ffolkes, M.A., F.M.S.
Kelstern	Lincoln	53 24	0 7 W.	388	D. G. Briggs, F.M.S.
Leaton	Salop	52 45	2 57 W.	266	Rev. E. V. Pigott, M.A., F.M.S.
Llandudno	Carnarvon	53 21	3 50 W.	79	J. Nicol, M.D., F.M.S.
Lowestoft	Suffolk	52 29	1 45 E.	85	S. H. Miller, F.R.A.S., F.M.S.
Mansfield	Notts	53 8	1 12 W.	349	W. Tyrer, F.M.S.
Marlborough	Wilts	51 25	1 43 W.	471	Rev. T. A. Preston, M.A., F.M.S.
Norwood	Surrey	51 26	0 6 W.	184	W. Marriott, F.M.S.
Ramsgate	Kent	51 20	1 25 E.	105	Rev. T. E. Egan, O.S.B.
Scaleby	Cumberland	54 58	2 52 W.	111	R. A. Allison, F.M.S.
Scarborough	Yorks	54 17	0 23 W.	130	F. Shaw, F.M.S.
South Bourne-on-Sea	Hants	50 44	1 48 W.	90	T. A. Compton, B.A., M.D., F.M.S.
Strathfield Turgiss	Hants	51 20	1 0 W.	195	Rev. C. H. Griffith, B.D., F.M.S.
Wakefield	Yorks	53 41	1 30 W.	96	H. Clarke, L.R.C.P., F.M.S.

Notes on the Tables on pages 6, 8 and 10.

Column 1 is the mean of the readings of the Barometer at 9 a.m. and 9 p.m. corrected for temperature and reduced to sea-level.

Column 4 is the mean of the readings of the Dry-Bulb Thermometer at 9 a.m. and 9 p.m.

Columns 5 to 10. The Maximum and Minimum Thermometers are read and set at 9 p.m., and the readings entered to the same day.

Columns 13 and 14. The Relative Humidity is calculated by dividing the elastic force of vapour, at the temperature of the dew-point, for the month, by that at the temperature of the air (*i.e.* dry-bulb reading).

Columns 15 and 16. The Amount of Cloud is estimated according to the scale 0—10, 0 representing a cloudless sky, and 10 a completely covered or overcast sky.

Columns 17 to 20. The Rain is measured at 9 a.m., and the amount entered to the previous day. A fall of ·006 in. and above constitutes a day of *rain.*

Column 21. When any Snow falls it is entered as a day of *snow.*

Columns 22 and 23. When the mean of the 9 a.m. and 9 p.m. observations of the amount of Cloud is less than 2·0, this is called a day of *clear sky*, but when the mean is above 8·0 it is called an *overcast* day.

Column 24. When the Force of the Wind is 7 and above (on the scale 0—12) this is counted as a *gale.*

Columns 25 to 33 give the sums of the observations of the Direction of the Wind at 9 a.m. and 9 p.m.

Abstract of Meteorological Observations for the Month of JULY, 1880.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature. 9 a.m.	Air Temperature. 9 p.m.	Air Temperature. Mean.	Means of Min.	Means of Max.	Absolute Min.	Date.	Absolute Max.	Date.	Wet Bulb Therm. 9 a.m.	Wet Bulb Therm. 9 p.m.	Relative Humid. 9 a.m.	Relative Humid. 9 p.m.	Amount of Cloud. 9 a.m.	Amount of Cloud. 9 p.m.	Rainfall. Total Fall.	Greatest Fall in 24 hours. Amnt.	Greatest Fall in 24 hours. Date.	Weather, No. of days of Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	Wind, No. of Observations of N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·823	58·7	56·1	57·4	51·8	65·0	45·7	31	72·8	17	55·6	54·3	81	88	8·3	8·0	6·02	1·31	13	20	0	1	20	1	1	7	11	0	1	14	8	1	19
Scarborough	·844	59·6	57·1	58·3	53·6	63·2	48·7	5	72·2	25	56·7	55·2	82	88	8·2	7·7	4·89	·98	14	25	0	0	16	1	7	5	5	10	5	12	15	3	0
Wakefield	·860	59·6	57·3	58·4	52·7	65·1	45·1	2	70·4	25	55·9	54·9	78	85	7·8	6·6	7·19	1·80	23	20	0	0	12	0	5	5	10	2	7	14	15	4	0
Kelstern	·869	59·5	55·4	57·4	50·6	65·1	42·6	5	71·7	25	56·8	54·1	83	91	7·6	6·9	5·37	·94	7	23	0	0	9	0	1	2	6	9	3	18	14	7	2
Mansfield	·872	59·0	56·4	57·7	52·4	65·3	47·2	21	71·5	25	56·7	55·0	85	91	8·2	7·3	6·13	·94	26	25	0	0	17	0	1	5	8	1	3	21	15	4	4
Buxton	....	56·9	56·4	56·7	50·0	65·2	40·0	4	70·7	17	55·1	55·1	88	91	8·1	7·6	7·30	1·26	26	17	0	0	12	0	0	0	5	8	0	5	16	28	0
Cheadle	·867	57·0	55·9	56·4	51·3	64·3	45·6	31	69·9	23	55·7	54·9	91	94	7·7	7·0	6·12	1·30	17	25	0	0	12	2	1	3	7	6	6	11	10	15	3
Llandudno ..	·856	59·9	57·7	58·8	54·0	64·3	49·0	21	71·7	17	56·5	55·4	79	85	6·4	7·4	6·66	1·16	14	19	0	2	10	0	9	1	5	4	3	7	26	7	0
Leaton	·881	60·3	56·1	58·2	51·4	67·4	45·0	5	74·9	17	58·0	55·1	85	93	8·0	6·6	8·17	1·31	12	25	0	0	12	..	..	..	..	..	..	..	..	..	..
Churchstoke..	·885	58·4	55·9	57·2	50·6	65·6	43·0	5	72·4	17	55·3	53·8	81	86	8·2	6·4	5·16	·94	14	21	0	0	9	0	1	0	0	8	5	19	10	15	4
Cheltenham ..	·883	61·4	58·3	59·9	51·7	68·7	41·2	5	74·0	15, 25	58·3	56·2	81	87	7·0	7·0	5·08	·79	14	24	0	1	9	0	2	0	0	0	11	9	22	3	15
Carmarthen ..	·882	62·4	56·9	59·6	52·5	67·6	44·4	11	76·9	17	58·1	55·4	75	90	7·5	6·5	7·24	1·01	27	21	0	3	15	0	6	2	1	2	5	16	15	2	13
Dartmoor	* ·933	56·2	52·5	54·3	49·6	60·7	44·0	14	69·0	16, 17	53·8	51·6	84	93	8·4	8·5	6·40	1·83	25	18	0	0	19	0	2	1	2	2	3	17	22	12	1
Babbacombe..	·928	63·0	56·8	59·9	53·4	68·2	47·1	31	75·0	16	58·7	54·9	75	88	6·7	5·5	2·56	·82	25	22	0	1	8	0	0	4	5	1	5	23	18	4	2
Downside	·906	59·6	56·0	57·8	52·6	66·2	47·3	5	75·4	16	56·9	54·9	83	93	7·5	6·1	6·69	1·27	2	22	0	1	11	0	1	6	1	0	4	36	12	2	0
Marlborough	·909	61·8	57·2	59·5	51·9	69·3	43·7	5	75·3	15	58·0	55·2	78	87	8·1	6·3	4·37	·66	13	21	0	0	14	0	0	3	3	0	8	22	11	2	13
Strathfield T.	·915	63·6	58·9	61·2	51·6	70·8	44·3	5	79·1	16	59·3	57·0	76	88	7·8	7·5	4·90	1·10	14	21	0	0	12	0	0	2	1	1	8	22	25	3	0
Norwood	·913	62·2	59·3	60·8	53·9	70·4	47·2	31	76·1	21	58·1	56·7	76	84	7·0	6·4	3·40	1·01	29	23	0	0	7	0	0	0	2	1	4	16	23	3	13
Croydon	·917	62·0	59·0	60·5	53·9	69·6	47·9	31	76·2	16	57·6	56·3	75	83	7·6	6·7	2·85	·79	29	21	0	0	7	0	0	1	0	0	8	24	12	4	13
South Bourne	·927	62·2	58·5	60·4	54·6	66·6	46·4	16	72·9	16	58·7	56·3	79	86	6·2	5·5	2·92	·72	28	17	0	2	8	3	1	0	2	5	1	29	14	7	3
*Ramsgate ..	...	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hillington ..	·874	61·9	56·2	59·0	51·3	69·2	43·3	11	76·5	15	58·9	55·1	82	92	8·2	8·3	5·31	1·11	14	22	0	0	15	0	0	7	2	9	3	26	3	12	0
Lowestoft	29·875	61·4	58·2	59·8	53·5	67·5	44·8	5	74·6	25	58·3	56·7	81	90	7·9	5·6	4·77	1·27	26	21	0	2	11	0	1	4	3	7	1	14	24	6	2
Columns··	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

* RAMSGATE.—The note book containing the original observations for July has unfortunately been lost.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	...	●	●☈	...	●	●	●	●	...	...	...	●	●	●	●	...	●	●	●	...	...	...	●	...	●	●	●	●	...	●	●
Scarborough	●	●	●T	...	...	●	●	●▲☈	●T	●	●	●	●	●	●≡	≡	●	●☈	●	●	...	...	☈	●☈	●	●	●	●	●☈	●☈	●▲
Wakefield	...	●	●	...	...	●	●	●	●	...	...	●T	●☈	●	●☈	...	●☈	●	●	...	...	...	●☈	●	●	●	●	●	●	...	...
Kelstern	●	●	●	●	...	●	●	●	●T	●	...	●	●T	●T	●≡	≡	●≡	☈	●☈	T	...	...	T	●	●	●	●	●	●	●	●
Mansfield	●	●	●	...	...	●	●☈	●	●T	●☈	●	●	●T<	●☈	●☈	≡	●<	...	●	...	●T	●	●☈≡	●<	●	●	●	●	●	●T	...
Buxton	●	●	●	...	...	●	●	...	...	●	●	●☈	...	●☈	●T	...	●<	...	...	...	...	...	...	●	...	●	●	●	●	●	...
Cheadle	...	●	●	...	...	●	●T	●	●T	T	●	●T	●☈	●	●☈	...	●☈≡	●☈	●	...	●	●	●	●	●	●	●	●	●☈	●T	●
Llandudno	...	●	●	...	...	●	●	●	...	●	●	●	T	●T	●☈	T	●☈	●☈	☈	...	...	...	●	●	●	●	●	●	...	●	...
Leaton	●	●	●	...	●	●	●	●	●	●	●	●☈	●☈	●☈	●☈	...	●☈	●	●	...	...	●☈	●	●	●	●	●	●	●	...	...
Churchstoke	...	●	●	...	...	●	●	●	●	...	●	●	●T	●<	●☈	...	●☈	●	...	...	...	...	●	...	●	●T	●	●	●	●	●
Cheltenham	●	●	●	...	...	●	●	●	●	●	●	●	●	●T	●	...	●☈	●	●	...	●	...	...	...	●	●	●	●	●T	●▲☈	●
Carmarthen	●	●	●	...	...	●	●	...	●	●	...	●	...	☈	...	≡	●≡T	●	●...	...	●☈	●T	●	●	●	●	●	●	●	●	●
Dartmoor	●	●≡	●≡	...	...	●≡	●≡	●	●≡	...	...	●	...	≡	...	...	O	●≡	...	...	...	≡	●≡	●	●O	●	●≡	●≡	●≡	●T	●
Babbacombe	●	●	●	...	...	●	●	●	●	●T	●	●	...	<	...	<	●≡<O	●<	●	...	●T	≡	≡Oʊ	●	●O	●	●	●	●<	●☈	●O
Downside	●	●	●T	...	...	●	●	●	●	●	...	●	●	●	...	...	●▲≡☈	●	T	...	T	☈	●	●	●	●T	●	●	●	●☈	●☈
Marlborough	●	●	●	...	...	●	●	●	●	●	...	●	●☈	●T	☈	≡<	●≡☈	●	...	...	●☈	≡	≡	...	●	●	●	●	●	●☈	●
Strathfield Turgiss	●	●	●	...	...	●	●	●	●	●☈	...	●	●	●☈	●▲☈≡	≡T	●≡☈	●☈	●	...	☈	≡	...	...	●	●T	<	●	●	●	●
Norwood	●☈O	●	●T	...	...	●	●≡	●T	●	●T	●	...	●	●≡☈	●≡T<	≡	●≡<	●☈	...	...	●☈	●	●	...	●	●	...	●	●▲☈	●▲≡☈	●
Croydon	●	●	●	...	...	●	●	●	●	●T	●	...	●	●T<	T<	T<	●≡<	T	...	...	●<	<	●	...	●	●	●	●	●T	●☈	●
South Bourne	...	●	●	...	...	●	●	...	...	●	...	●	●	...	☈	...	●	...	...	●	●	☈	≡	...	●	●	●	●	●	●	●
Ramsgate	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hillington	●	●	●T	●	...	●	●	●▲T	●T	●☈O	●	●	●☈	●☈	●	T	●<	☈	●☈	T	...	...	...	...	●	●T	●	●	●T	●T	T
Lowestoft	●☈	●	●	●	...	●	●	●☈	●	●	●	...	...	●	●	...	≡	...	...	●▲T	...	...	...	●	●	●	●	●	●☈	●	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; ☈ thunderstorm; T thunder; < lightning; O solar halo; ʊ lunar halo.

Abstract of Meteorological Observations for the Month of AUGUST, 1880.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature. 9 a.m.	Air Temperature. 9 p.m.	Air Temperature. Mean.	Means of Min.	Means of Max.	Absolute Min. and Max. Min.	Date.	Max.	Date.	Wet Bulb Therm. 9 a.m.	Wet Bulb Therm. 9 p.m.	Relative Humid. 9 a.m.	Relative Humid. 9 p.m.	Amount of Cloud. 9 a.m.	Amount of Cloud. 9 p.m.	Rainfall. Total Fall.	Greatest Fall in 24 hours. Amnt.	Greatest Fall in 24 hours. Date.	Weather, No. of days of Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	Wind, No. of Observations of N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	30·032	61·4	58·0	59·7	52·1	68·1	44·0	3	77·0	14	58·2	56·1	81	88	6·2	4·6	1·27	·55	4	8	0	8	11	0	5	10	19	0	0	2	9	1	16
Scarborough	·030	61·8	59·2	60·5	56·3	64·7	50·5	3	76·3	10	58·9	57·5	83	89	6·8	7·6	1·96	·59	7	13	0	4	17	0	22	15	10	1	3	5	3	3	0
Wakefield	·048	61·7	59·2	60·5	54·4	68·8	42·5	1	78·6	11	58·2	57·2	79	87	7·4	6·5	1·57	·84	7	13	0	1	13	0	17	17	6	2	1	6	8	5	0
Kelstern	·038	60·6	57·2	58·9	53·5	67·0	45·3	1	78·2	26	58·0	56·5	84	95	7·1	7·1	1·88	·74	26	9	0	2	14	0	5	32	6	0	1	6	6	4	2
Mansfield	·041	60·8	57·9	59·3	54·2	68·0	44·0	1	77·9	10	57·6	56·3	81	90	7·8	6·6	2·46	1·35	7	11	0	3	16	0	12	20	11	1	4	2	9	1	2
Buxton	·053	59·1	57·5	58·3	51·9	67·2	45·1	25	76·6	11	56·4	55·8	83	89	7·2	5·9	2·64	1·49	7	6	0	2	12	0	1	2	28	1	0	2	9	13	6
Cheadle.	·029	58·8	58·2	58·5	52·9	67·1	47·0	7	78·0	11	56·6	56·3	86	88	7·3	4·9	3·42	2·33	7	7	0	1	7	1	3	8	31	0	2	5	2	6	5
Llandudno ..	·032	61·9	60·6	61·3	56·1	66·6	50·5	1	71·0	10	58·7	58·1	81	85	6·2	3·4	1·85	1·17	7	5	0	8	7	0	8	6	21	10	1	2	11	3	0
Leaton	....	..	..	..	52·6	69·5	45·0	10	78·0	11	..	..	..	..	..	..	·85	·45	7	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Churchstoke..	·050	59·1	58·5	58·8	52·9	67·9	43·2	24	75·9	11	56·6	56·4	84	87	8·0	4·9	1·24	·87	7	4	0	3	12	0	3	13	10	5	0	5	3	3	20
Cheltenham	·018	61·0	59·6	60·3	53·4	70·5	44·2	3	79·1	11	58·3	57·0	83	84	7·9	5·0	·49	·15	6	5	0	3	11	0	7	19	0	1	2	3	7	5	18
Carmarthen ..	·014	64·7	60·4	62·6	55·4	71·1	49·1	9	79·5	28	60·0	58·2	74	85	6·1	3·9	·81	·28	7	7	0	7	9	0	10	2	29	0	7	3	5	2	4
Dartmoor	·023	58·3	56·4	57·4	52·5	64·2	48·0	10	71·0	11	56·3	55·1	87	91	7·4	6·7	1·20	·36	25	8	0	4	15	0	1	11	22	3	3	6	5	4	7
Babbacombe..	·011	61·5	61·0	61·2	56·6	68·6	50·8	9	76·6	31	58·8	58·5	84	85	8·1	5·2	·31	·08	1, 6	5	0	1	9	1	5	26	11	1	0	5	6	7	1
Downside	·013	59·8	59·3	59·6	54·5	69·9	49·9	23	78·4	30	57·7	57·6	87	89	8·4	4·6	·81	·34	6	7	0	2	13	1	2	33	3	0	3	13	2	6	0
Marlborough	·018	60·6	58·9	59·7	54·1	70·8	46·0	31	77·7	10	57·9	57·1	84	89	8·6	4·7	1·35	·41	5	8	0	1	11	0	2	12	4	0	1	0	4	1	38
Strathfield T.	·004	63·3	59·9	61·6	54·2	72·4	43·5	3	78·8	28	59·8	58·0	79	88	8·1	4·4	1·03	·51	25	9	0	3	10	0	0	40	2	0	2	8	6	4	0
Norwood	·005	62·4	60·3	61·3	55·6	71·2	46·8	3	79·6	28	58·9	58·1	79	86	8·3	6·1	·39	·17	7	6	0	2	12	1	4	31	3	0	3	2	5	3	11
Croydon	·005	62·2	60·2	61·2	55·3	70·5	46·5	3	78·1	28	58·8	58·0	80	86	8·7	5·9	·40	·28	7	7	0	2	15	0	3	23	9	0	1	6	7	2	11
South Bourne	30·003	62·0	60·7	61·3	55·4	69·6	47·2	10	75·8	13	58·8	58·4	81	86	7·1	3·2	1·14	·39	2	6	0	3	5	2	12	29	1	3	1	4	4	5	3
Ramsgate	29·993	64·8	61·5	63·2	58·5	69·9	49·1	2	76·1	5	62·9	60·5	89	94	7·1	5·9	1·06	·46	8	5	0	1	10	0	2	35	0	0	1	8	1	0	15
Hillington ..	30·006	63·8	57·7	60·8	53·4	69·8	43·4	3	78·3	31	60·4	57·0	80	96	7·5	7·5	1·82	·89	7	8	0	2	17	0	0	35	4	3	0	6	3	9	2
Lowestoft	29·992	62·9	59·9	61·4	56·7	67·3	47·8	3	72·3	31	60·2	58·4	84	91	6·5	5·6	1·69	1·38	7	8	0	5	12	0	7	25	7	3	1	5	5	6	3
Columns ..	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Scaleby	...	●	●	●	●	●	●	...	...	●	...	...	...	...	...	...	...	...	...	...	...	...	●	...	...	...	...	...	...	...	...
Scarborough	●	●	●	...	...	●	●	●☈	...	≡	...	...	...	...	...	●	●	...	...	...	...	●	●	●	●	●	...	...	...	...	...
Wakefield	●	●	●	...	●	●	●	...	...	...	...	...	...	...	...	●	●	...	...	...	...	●	●	●	...	●	...	...	●	☈	...
Kelstern	●	●	...	...	...	●T	●	●☈	...	...	...	...	≡	...	...	≡	...	...	...	●	≡	...	...	≡	●	●☈≡	●≡	≡<	...	<	≡
Mansfield	●	●	●	...	●	●☈	●	...	...	...	...	...	...	...	...	●	●	...	●	...	...	...	...	...	●	≡<	<	≡	●☈	...	...
Buxton	●	...	●	...	●	●T	●	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	≡☈	...	●	☈	...
Cheadle	●	...	●	...	●	●T	●☈	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	●☈	T	●	☈	...
Llandudno	●	...	●	...	●	●	●	...	...	...	≡	...	≡	...	...	...	...	≡	...	...	...	...	...	≡	...	≡	...	...	...	...	...
Leaton	●	...	...	...	...	●	●	●	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Churchstoke	●	...	●	...	...	●	●T	...	...	...	...	...	T	...	...	...	...	...	...	...	...	...	...	...	...	...	≡	≡	...	...	≡
Cheltenham	●	...	...	...	●	●	●	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	●☈	≡	<	...	...	T
Carmarthen	●	...	...	●	●	●	●	...	≡	...	...	...	...	...	T	...	...	...	...	...	...	...	●	●	...	...	...	<	<	...	...
Dartmoor	●	...	●≡	≡	≡	●≡	●≡	●	...	...	...	≡	...	...	...	≡	≡	...	...	...	...	...	●	≡	●☈≡	●☈≡	...	...	<	...	...
Babbacombe	●	...	...	...	≡	●	●	...	...	≡	≡	...	...	...	●	≡	T	...	...	...	...	...	...	...	●<	≡<	≡	<	<	...	≡
Downside	●	T	...	●	...	●☈	●	...	...	...	...	...	...	...	...	≡	...	...	...	...	...	...	●	...	≡	●☈≡	≡	●T≡	...	T≡	≡
Marlborough	●	●T	...	...	●	●	●	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	●	...	●☈	...	●☈	...	...	...
Strathfield Turgiss	●≡	●≡	...	...	●	●	●	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	●	●≡	☈≡	≡	≡	●<	●	...
Norwood	●	●	...	...	...	●≡	●	●T	...	≡	≡	≡	≡	≡	≡	...	...	...	≡	≡	≡	...	...	●	...	≡<	≡	...	☈	☈	≡
Croydon	●	●	...	...	...	●	●	●	...	...	T≡	...	...	...	...	●	...	...	...	...	...	...	<	<	●T	≡T<	≡	≡	<	☈	≡
South Bourne-on-Sea	●	●☈	...	...	●	●	●	...	...	≡	...	...	...	...	...	...	...	...	...	...	...	...	●	...	☈	...	...	...	...	...	...
Ramsgate	...	...	●	...	...	...	●	●	●	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	●	...
Hillington	●	●☈	...	...	...	●☈	●☈	●☈	...	...	...	...	...	...	...	...	...	...	●	...	...	...	...	...	●	●☈	...	...	...	...	...
Lowestoft	●	●	...	...	○	●	●	●	...	...	...	...	...	...	...	...	...	...	●	●	...	...	...	...	●<	T<	≡	≡	<	...	...

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; ☈ thunderstorm; T thunder; < lightning; ○ solar halo; Ʊ lunar halo.

Abstract of Meteorological Observations for the Month of SEPTEMBER, 1880.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature. 9 a.m.	Air Temperature. 9 p.m.	Air Temperature. Mean.	Means of Min.	Means of Max.	Absolute Min.	Absolute Min. Date.	Absolute Max.	Absolute Max. Date.	Wet Bulb Therm. 9 a.m.	Wet Bulb Therm. 9 p.m.	Relative Humid. 9 a.m.	Relative Humid. 9 p.m.	Amount of Cloud. 9 a.m.	Amount of Cloud. 9 p.m.	Rainfall. Total Fall.	Greatest Fall in 24 hours. Amnt.	Greatest Fall in 24 hours. Date.	Weather, No. of days of Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	Wind, No. of Observations of N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Scaleby	29·921	58·1	54·6	56·4	48·3	64·1	37·0	20	80·7	4	56·8	54·0	92	96	6·4	5·8	4·06	·77	14	17	0	6	13	1	5	0	5	2	2	14	9	1	22
Scarborough	·931	58·8	57·7	58·3	53·2	63·2	44·0	20	74·8	3	56·1	55·7	83	87	6·3	4·4	3·50	1·41	11	14	0	8	10	1	5	4	2	6	5	14	17	7	0
Wakefield....	·953	58·8	56·5	57·7	50·1	66·2	43·1	18, 20	82·8	4	55·6	54·6	80	88	6·4	5·8	4·80	·98	14	15	0	5	12	0	6	4	4	3	3	11	25	4	0
Kelstern	·963	59·2	55·3	57·3	50·4	66·0	41·7	20	81·3	4	56·4	33·8	83	90	5·7	4·9	5·14	1·87	14	11	0	7	8	0	1	6	3	4	4	15	17	8	2
Mansfield	·963	59·2	55·1	57·2	50·6	65·2	41·8	8	75·7	5	56·3	54·1	82	93	6·4	5·5	4·64	1·19	15	13	0	4	10	0	3	5	1	3	4	26	13	4	1
Buxton	·985	56·5	53·3	54·9	48·6	63·1	40·0	8	80·1	4	54·1	51·9	84	90	7·7	6·3	6·15	1·18	12	14	0	1	12	0	0	4	1	2	2	13	6	16	16
Cheadle......	·963	56·2	55·3	55·8	50·3	63·7	41·4	19	80·9	4	54·5	53·7	89	89	6·2	5·5	3·41	·73	12	15	0	6	11	0	8	3	4	3	2	13	9	10	8
Llandudno ..	·954	59·4	57·8	58·6	54·3	63·4	47·0	19	81·8	4	56·6	55·5	83	85	6·9	5·3	2·16	·40	22	16	0	5	12	2	8	3	2	3	1	11	27	5	0
Leaton	·957	58·6	54·9	56·7	49·0	65·7	36·9	8	83·1	4	56·0	53·5	84	91	7·1	5·8	1·73	·37	12	17	0	3	14	..	..	..	..	..	..	..	..	..	..
Churchstoke..	·983	57·4	55·0	56·2	49·7	64·3	38·4	8	81·0	3	54·6	53·3	82	88	7·2	6·2	1·99	·46	15	11	0	4	16	0	4	2	1	3	6	12	5	12	15
Cheltenham ...	·976	59·4	55·1	57·2	49·5	66·4	40·1	7	83·5	4	56·7	53·8	83	91	6·9	4·9	4·51	·99	14	14	0	3	6	0	6	2	0	3	6	5	17	1	20
Carmarthen ..	29·975	58·9	56·1	57·5	51·7	65·1	41·4	19	83·0	4	56·9	55·2	87	94	7·9	6·7	4·33	1·25	14	19	0	2	15	0	7	2	3	2	5	9	10	3	19
Dartmoor	30·017	55·5	52·5	54·0	48·6	60·6	42·0	18, 19, 20	73·0	3, 4	54·4	51·8	92	95	8·2	7·3	7·02	1·42	14	13	0	0	15	0	4	10	10	2	1	8	12	12	1
Babbacombe..	30·001	60·3	56·5	58·4	53·3	65·9	43·7	20	76·5	2	57·9	54·9	85	89	7·6	6·1	3·52	·91	13	15	0	1	12	2	2	8	5	1	5	14	13	9	3
Downside	29·991	57·6	55·1	56·3	51·5	65·3	44·9	19, 20	83·2	4	56·0	54·5	90	96	7·3	6·1	5·86	·87	12	14	0	4	13	1	2	3	2	3	1	23	16	4	6
Marlborough	·997	58·9	55·3	57·1	50·8	67·4	40·1	20	84·5	4	56·6	54·2	86	92	6·9	5·6	3·94	1·01	12	15	0	4	11	0	1	3	1	0	3	1	6	9	36
Strathfield T.	·996	60·5	55·8	58·2	50·8	68·6	41·4	20	85·0	4	57·9	54·6	84	92	7·8	5·3	4·63	1·55	11	14	0	4	10	0	1	5	0	2	6	22	15	3	6
Norwood	·997	60·5	56·5	58·5	51·4	68·6	42·8	20	85·6	4	57·3	54·6	80	88	6·8	4·5	4·56	1·51	11	13	0	6	10	0	3	2	7	1	5	3	13	3	23
Croydon	29·996	60·9	56·6	58·8	51·7	68·1	44·1	20	85·1	4	57·5	54·7	79	87	7·3	3·6	4·45	1·33	11	15	0	4	7	0	2	2	3	4	3	13	10	3	20
South Bourne	30·000	60·1	57·7	58·9	53·8	65·6	42·3	30	74·3	4	57·7	56·0	85	89	6·8	4·5	3·33	·80	11	15	0	4	6	3	6	4	8	2	5	10	7	13	5
Ramsgate	30·012	61·6	58·6	60·1	54·5	67·9	44·2	20	79·2	4	59·5	57·5	87	93	6·7	5·5	1·85	·34	11	11	0	4	12	0	2	1	2	0	20	8	1	0	26
Hillington.....	29·961	61·3	55·2	58·2	50·1	68·1	39·2	8	85·1	4	58·2	54·1	81	92	7·0	6·5	3·88	1·24	11	12	0	2	13	0	3	7	2	9	2	14	7	14	2
Lowestoft	29·964	60·1	58·0	59·0	52·8	67·1	42·8	20	78·0	1	57·6	56·0	84	87	6·4	3·7	2·45	1·07	14	13	0	8	7	0	4	2	4	4	4	9	21	6	6
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Range.	Mean Amount of Cloud at 9 a.m.	Rain. Amount.	Rain. No. of Days.
° 44.1	5.9	In. 3.62	17
45.0	6.2	5.33	18
41.3	7.1	5.17	19
35.1	6.5	3.62	15
43.2	7.1	4.25	19
44.0	7.7	3.68	19
41.8	6.5	3.83	20
39.1	7.0	2.27	13
43.1	8.7	2.13	13
44.6	5.8	4.61	15
40.3	4.3	3.77	14
37.2	5.5	4.13	14
39.7	7.2	4.27	15
45.1	7.3	4.22	13
48.3	6.2	4.84	12
43.8	6.8	5.04	15
40.3	7.9	2.85	13
43.6	..	3.62	15
36.8	..	3.67	15
38.1	6.9	3.16	15
31.0	..	..	..
34.5	7.1	4.91	17
31.4	7.7	3.75	19
34.8	7.2	3.71	15

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Scaleby	●	●	≡	●	●	...	...	...	...	●	...	●	...	●	●	...	●	●	●	●	●
Scarborough	...	●	...	...	...	...	...	...	...	●	●	●	●	●☈	●	●	●	●T	●T<	●	●
Wakefield	...	...	...	●	●	...	...	...	...	●	●	●	...	●☈	●	●	●	●	●	●	●
Kelstern	≡	...	...	☈	●	...	...	...	...	●	●	●☈	...	●☈	●<	...	●	●☈	●T	T	●
Mansfield	...	...	...	T	●	...	...	...	...	●	●	●	...	●<	●	●	●	●☈	●☈	●	●
Buxton	...	...	...	≡	●<	...	...	...	...	●	●	●T	●Tɯ	●☈	●	●	●	●▲☈	●▲T☈	●▲T	●
Cheadle	...	T	...	<	●	...	...	...	●	●	●	●	●	●☈	●	●	●	●☈	●T	...	●
Llandudno	●	...	...	☈	●	...	...	...	●	●	...	●	●ɯ	●	●	...	●	●☈	●	●	●
Leaton	●	...	...	...	●	...	...	...	●	●	●	●	●	●	●	●	●	●	●	●	●
Churchstoke	...	...	...	...	●	...	...	...	●	●	...	●	●	●	●	●	●	●	...	●	...
Cheltenham	...	...	...	...	●	...	...	...	●	...	●	●	●ɯ	●	●	●T	●	●☈	...	●	●
Carmarthen	●	●	...	...	●	...	...	...	●	●	●	●	●	●	●	...	●	●	...	●	●≡
Dartmoor	≡	...	...	≡	●≡	≡	...	●	●	≡	≡	≡	...	●	●	●	●≡	●	●	●	●≡
Babbacombe	≡	≡	≡	...	●	●	○	●	●≡	●	●<	●<	●▲T	●	●	...	●	●	●	●	...
Downside	≡	...	...	●	●	...	...	...	●	●	●	●	●	●	●	●	●	●	...	●	...
Marlborough	≡	...	...	●	●	●	...	...	●	●	●	●	●ɯ	●	●	...	●	●	●	●	●
Strathfield Turgiss	...	...	...	...	...	●	...	≡	●≡	...	●	●	●ɯ	●	●	●	●	●	●	●	●≡
Norwood	≡	...	≡	≡	...	●○	≡	≡	≡	≡	●≡	●	●▲☈ɯ	●	●	●≡	●≡	●	●	●	●≡
Croydon	...	...	...	≡	...	●	...	●≡	...	●≡	●	●	●▲Tɯ	●☈	●	●≡	●≡	●	●	●	●≡
South Bourne-on-Sea	...	...	...	●	●	●	...	●	●	●	●	●	●	●	●	...	●	●	●	●	...
Ramsgate	...	...	...	...	...	...	●	●	●	●	●	●	●☈	●	...	...	...	●	...	●	...
Hillington	...	...	...	●<	...	...	...	≡	...	...	●☈	●☈	...	●T<	●	●	●	●☈	●▲☈	●	●
Lowestoft	...	...	...	...	...	●	...	...	...	...	●	●☈	●	●	●	●	●	●	●T<	●<	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; ☈ thunderstorm; T thunder; < lightning

Abstract of Climatological Observations for the Quarter ending SEPTEMBER 30th, 1880.

Station.	JULY.												AUGUST.												SEPTEMBER.							
	Means at 9 a.m.		Temperature.							Mean Amount of Cloud at 9 a.m.	Rain.		Means at 9 a.m.		Temperature.							Mean Amount of Cloud at 9 a.m.	Rain.		Means at 9 a.m.		Temperature.					
			Means.				Extremes in Month.								Means.				Extremes in Month.								Means.				Extrem[es in] Mont[h].	
	Temperature.	Humidity.	Min.	Max.	Range.	Mean.	Min.	Max.	Range.		Amount.	No. of Days.	Temperature.	Humidity.	Min.	Max.	Range.	Mean.	Min.	Max.	Range.		Amount.	No. of Days.	Temperature.	Humidity.	Min.	Max.	Range.	Mean.	Min.	Max.
	°	o/o	°	°	°	°	°	°	°		In.		°	o/o	°	°	°	°	°	°	°		In.		°	o/o	°	°	°	°	°	°
Stapleton	57·1	87	48·9	64·6	15·7	56·7	40·0	72·2	32·2	7·7	5·38	22	60·9	83	49·4	68·6	19·2	59·0	39·1	79·9	40·8	7·1	1·45	7	56·9	86	47·1	63·7	16·6	55·4	36·0	80·1
Alston	55·8	81	46·5	62·3	15·8	54·4	35·8	72·8	37·0	8·2	6·34	24	58·4	82	46·6	65·8	19·2	56·2	39·8	75·8	36·0	6·5	1·12	13	54·0	85	45·0	61·6	16·6	53·3	32·8	77·[illegible]
Cockermouth	60·2	76	53·0	66·6	13·6	59·8	45·9	76·0	30·1	7·6	4·46	21	64·6	70	52·8	71·9	19·1	62·3	44·6	82·1	37·5	5·1	·92	5	58·5	83	50·8	64·4	13·6	57·6	40·9	82·[illegible]
Scarborough ..	58·6	86	52·1	62·9	10·8	57·5	46·2	71·8	25·6	6·7	5·33	25	61·1	85	54·7	64·9	10·2	59·8	49·2	75·5	26·3	6·6	2·20	14	58·2	87	50·7	64·4	13·7	57·6	42·0	77·1
Blackburn ..	59·4	83	50·9	68·7	17·8	59·8	46·0	78·5	32·5	8·2	5·93	25	63·1	78	50·5	74·1	23·6	62·3	42·0	86·0	44·0	6·1	2·15	10	58·3	84	49·3	64·3	15·0	56·8	39·4	82·[illegible]
St. Mich.-on-Wyre	..	..	52·8	65·8	13·0	59·3	43·6	73·8	30·2	..	3·22	22	62·6	78	52·6	70·5	17·9	61·6	45·3	78·8	33·5	..	1·95	7	59·0	84	50·3	65·1	14·8	57·7	39·0	83·[illegible]
Blackpool	59·5	81	53·9	63·7	9·8	58·8	44·1	71·9	27·8	6·9	3·00	16	61·9	79	52·6	68·2	15·6	60·4	47·0	76·8	29·8	5·1	1·85	5	58·7	83	51·8	63·6	11·8	57·7	40·6	82·[illegible]
Colwyn Bay ..	60·1	85	52·4	65·9	13·5	59·2	47·0	73·4	26·4	7·6	6·08	17	62·8	85	53·2	69·2	16·0	61·2	46·5	75·2	28·7	6·9	1·93	4	59·9	88	51·8	65·1	13·3	58·4	44·9	84·[illegible]
Chester	60·9	78	53·6	67·7	14·1	60·7	47·6	78·0	30·4	8·2	6·66	26	62·8	76	53·9	71·9	18·0	62·9	47·2	79·1	31·9	6·6	2·03	6	59·5	79	51·4	67·2	15·8	59·3	42·8	85·[illegible]
Hodsock	60·2	80	52·8	66·6	13·8	59·7	44·7	71·8	27·1	8·2	5·24	22	61·6	82	54·2	69·5	15·3	61·9	41·7	78·2	36·5	8·0	2·56	13	59·4	82	50·0	67·3	17·3	58·6	39·5	84·1
Belper	58·5	84	52·8	65·3	12·5	59·1	45·2	71·7	26·5	6·8	5·88	26	59·8	86	54·8	67·3	12·5	61·0	46·0	76·5	30·5	6·5	3·50	10	57·1	85	51·2	64·4	13·2	57·8	40·8	81·1
Beacon Stoop	54·3	88	49·7	60·1	10·4	54·9	44·6	65·3	20·7	8·6	4·69	25	56·2	90	51·6	63·2	11·6	57·4	46·9	72·1	25·2	8·0	3·40	6	54·2	91	49·0	61·0	12·0	55·0	39·3	76·5
Farley	58·2	83	51·1	64·6	13·5	57·9	45·8	70·5	24·7	8·3	5·73	26	60·7	80	53·5	67·8	14·3	60·6	47·2	78·8	31·6	7·8	2·78	7	58·0	83	50·4	63·8	13·4	57·1	41·1	80·[illegible]
Oakamoor	59·4	78	51·0	65·3	14·3	58·1	40·1	71·1	31·0	8·0	5·82	24	61·5	78	52·2	68·6	16·4	60·4	41·3	78·7	37·4	7·7	3·84	6	58·6	82	48·1	64·7	16·6	56·4	36·1	81·[illegible]
Loughborough	60·5	85	54·1	68·6	14·5	61·4	47·1	75·6	28·5	8·4	5·38	20	61·3	83	55·5	70·9	15·4	63·2	46·9	80·8	33·9	8·2	1·51	6	59·4	84	52·4	68·0	15·6	60·2	38·9	87·[illegible]
Kenilworth ..	60·0	82	52·3	67·6	15·3	59·9	45·3	72·6	27·3	8·3	5·83	25	60·7	85	54·0	68·5	14·5	61·3	45·8	77·2	31·4	8·5	1·29	7	58·8	84	50·6	66·5	15·9	58·5	40·6	84·[illegible]
Burghill	60·8	80	52·0	68·9	16·9	60·5	46·2	74·7	28·5	7·5	5·75	23	61·8	80	54·2	70·5	16·3	62·3	45·5	79·7	34·2	8·4	·20	4	59·1	83	50·7	66·6	15·9	58·7	42·0	82·[illegible]
Ross	61·4	82	53·7	69·8	16·1	61·7	45·8	75·0	29·2	7·9	5·96	24	61·7	83	55·4	71·6	16·2	63·5	47·1	81·0	33·9	8·1	·30	4	59·9	83	51·8	67·6	15·8	59·7	40·4	84·[illegible]
Cardiff........	62·3	77	55·1	68·3	13·2	61·7	47·4	72·3	24·9	..	6·64	23	61·8	80	56·5	69·8	13·3	63·1	50·1	78·3	28·2	..	·77	7	60·0	84	53·2	66·2	13·0	59·7	44·7	81·[illegible]
Weston-s-Mare	61·6	81	55·9	66·9	11·0	61·4	51·7	75·0	23·3	7·4	5·12	24	62·0	80	56·9	70·2	13·3	63·6	52·5	80·0	27·5	7·6	·64	8	59·9	84	54·7	67·0	12·3	60·8	47·8	85·[illegible]
Ilfracombe ..	61·3	82	56·8	65·8	9·0	61·3	52·0	71·0	19·0	6·5	5·13	18	..	..	59·2	67·3	8·1	63·3	55·0	73·0	18·0	..	·78	7	..	..	56·9	65·8	8·9	..	52·0	83·[illegible]
Ashburton	62·3	81	53·0	68·5	15·5	60·8	47·0	76·1	29·1	6·8	4·66	21	63·0	86	55·9	70·7	14·8	63·3	51·9	76·6	24·7	7·1	1·03	7	60·2	90	52·5	66·5	14·0	59·5	42·1	76·[illegible]
Maker	60·1	86	54·6	67·1	12·5	60·9	49·3	74·7	25·4	6·9	3·62	23	61·8	85	57·6	70·5	12·9	64·0	53·3	77·7	24·4	6·7	·87	11	58·6	91	55·0	64·8	9·8	59·9	48·6	80·[illegible]
Bridgetown....	64·5	72	52·8	69·9	17·1	61·4	42·5	76·5	34·0	5·4	3·12	23	64·5	80	55·5	72·1	16·6	63·8	46·4	79·0	32·6	7·1	·69	7	61·4	82	52·2	68·4	16·2	60·3	43·3	78·1

[...]ations of

SW.	W.	NW.	Calm.
14	9	1	22
14	17	7	0
11	25	4	0
15	17	8	2
26	13	4	1
13	6	16	16
13	9	10	8
11	27	5	0
..	..	..	..
12	5	12	15
5	17	1	20
9	10	3	19
8	12	12	1
14	13	9	3
13	16	4	6
1	6	9	36
12	15	3	6
3	13	3	23
13	10	3	20
10	7	13	5
8	1	0	26
14	7	14	2
9	21	6	6
10	31	32	33

Abstract of Climatological Observations for the Quarter ending

Station.	JULY. Means at 9 a.m. Temperature.	Humidity.	Temperature. Means. Min.	Max.	Range.	Mean.	Extremes in Month. Min.	Max.	Range.	Mean Amount of Cloud at 9 a.m.	Rain. Amount.	No. of Days.	AUGUST. Means at 9 a.m. Temperature.	Humidity.	Temperature. Means. Min.	Max.	Range.	Mean.	Extremes in Month. Min.	Max.	Range.	Mean Amount of Cloud at 9 a.m.	Rain. Amount.	No. of Days.	Means at 9 a.m. Temperature.	Humidity.	Min.
	°	o/o	°	°	°	°	°	°	°		In.		°	o/o	°	°	°	°	°	°	°		In.		°	o/o	°
Torquay, C. C.	62·3	77	54·3	67·1	12·8	60·7	48·9	75·0	26·1	6·5	2·31	20	62·3	83	56·7	68·5	11·8	62·6	51·8	75·7	23·9	6·0	·25	4	60·7	85	54·1
Torquay, R. ..	61·7	78	53·4	67·4	14·0	60·4	48·0	77·1	29·1	7·2	1·86	20	61·8	83	56·3	70·6	14·3	63·5	52·0	77·1	25·1	7·9	·18	4	59·5	86	53·5
Teignmouth, B.	62·2	75	54·4	68·3	13·9	61·4	49·0	74·5	25·5	7·1	2·64	19	63·1	78	57·5	70·3	12·8	63·9	52·8	76·5	23·7	7·8	·73	7	60·7	82	54·1
Teignmouth, W.	63·7	77	51·8	71·1	19·3	61·5	44·0	78·5	34·5	6·2	3·02	21	64·7	79	55·0	73·0	18·0	64·0	49·3	79·0	29·7	7·0	·71	5	62·3	85	52·1
Sidmouth	60·8	81	53·9	65·6	11·7	59·8	49·6	73·8	24·2	7·0	3·90	21	61·8	81	56·5	69·0	12·5	62·7	49·8	80·2	30·4	7·5	·51	5	59·0	89	53·7
Cullompton ..	62·9	76	52·1	68·6	16·5	60·4	45·3	76·7	31·4	6·7	5·03	23	62·9	78	54·6	71·6	17·0	63·1	45·4	79·1	33·7	7·4	·32	3	59·6	85	51·1
Ventnor	61·5	86	54·6	66·3	11·7	60·4	48·5	74·5	26·0	6·7	3·38	17	63·9	81	57·7	70·7	13·0	64·2	52·0	76·1	24·1	6·3	·71	8	61·6	84	56·1
Portsmouth ..	63·5	78	52·1	69·9	17·8	61·0	43·2	74·3	31·1	5·5	3·68	19	63·9	79	51·3	72·0	20·7	61·6	42·5	76·8	34·3	6·4	·62	6	61·1	81	49·2
Worthing	62·8	79	55·4	66·7	11·3	61·1	47·4	74·4	27·0	6·4	3·31	16	64·4	78	56·8	71·5	14·7	64·1	49·7	77·0	27·3	5·9	2·22	5	61·6	84	53·9
Eastbourne ..	62·5	79	55·9	67·5	11·6	61·7	49·2	75·0	25·8	8·0	2·77	15	65·7	74	57·2	72·1	14·9	64·6	51·2	79·2	28·0	7·1	·39	4	61·5	80	54·0
Southampton..	62·3	77	52·1	68·9	16·8	60·5	43·9	78·6	34·7	7·4	4·79	22	62·5	81	54·5	72·0	17·5	63·2	44·9	78·8	33·9	7·0	1·05	10	59·7	86	51·4
Harestock	60·9	74	51·9	67·8	15·9	59·9	45·4	75·9	30·5	6·7	5·75	22	61·2	77	53·9	70·3	16·4	62·1	44·6	77·0	32·4	7·8	1·17	8	59·2	79	51·2
Swarraton	61·3	78	51·8	68·0	16·2	59·9	43·2	76·4	33·2	7·5	4·97	21	60·8	84	53·5	70·0	16·5	61·8	41·6	76·4	34·8	8·1	1·53	7	58·7	87	50·6
Cranleigh	62·5	80	51·9	70·2	18·3	61·1	45·2	80·3	35·1	7·6	5·18	19	63·6	82	54·0	72·7	18·7	63·3	45·2	78·9	33·7	7·8	·89	6	60·6	85	50·5
Tunb. Wells ..	60·7	84	53·4	67·9	14·5	50·7	47·1	77·4	30·3	7·9	2·57	19	61·6	84	55·0	68·9	13·9	61·9	47·6	75·1	27·5	8·3	1·97	7	59·7	88	52·1
Tunbridge	63·6	75	54·5	71·0	16·5	62·7	47·0	80·8	33·8	6·9	2·64	18	64·4	79	56·2	71·4	15·2	63·8	47·1	79·1	32·0	7·9	1·26	6	..	..	..
Isleworth	63·0	76	53·9	70·8	16·9	62·3	46·4	77·3	30·9	7·7	3·86	23	63·0	80	55·5	71·9	16·4	63·7	47·1	80·3	33·2	8·7	·36	7	60·3	83	52·0
Watford	61·7	79	54·1	68·7	14·6	61·4	47·6	75·2	27·6	6·7	4·52	22	..	..	..	..	..	..	47·5	78·4	30·9	..	·50	5	..	..	..
Aspley Guise ..	61·2	79	52·8	68·5	15·7	60·6	46·6	74·7	28·1	7·6	6·21	24	61·1	82	54·6	69·4	14·8	62·0	48·1	78·7	30·6	8·3	·46	8	60·1	83	51·5
Throcking	59·6	85	52·6	67·1	14·5	59·9	46·6	71·7	25·1	7·7	5·23	22	59·8	90	54·3	67·8	13·5	61·0	47·6	76·8	29·2	8·4	1·09	7	58·2	86	52·0
Somerleyton ..	61·4	81	53·1	68·1	15·0	60·6	44·4	74·4	30·0	7·0	4·23	23	62·8	84	56·0	67·6	11·6	61·8	48·1	74·0	25·9	6·6	2·53	9	60·6	84	51·6
Cromer	61·5	80	..	..	..	..	..	..	..	7·6	5·05	24	62·2	84	56·7	..	..	..	49·1	..	..	7·3	1·91	9	61·4	90	..
Guernsey	61·7	84	54·1	68·2	14·1	61·2	51·1	75·9	24·8	5·5	2·25	14	62·0	90	56·7	68·1	11·4	62·4	52·1	75·7	23·6	8·1	·38	6	60·7	88	54·6
Limavady	59·6	82	50·5	65·1	14·6	57·8	42·2	71·4	29·2	7·0	4·89	21	63·9	77	53·5	70·0	16·5	61·7	45·3	78·7	33·4	5·5	1·22	7	58·9	81	50·2

List of the Climatological Stations.

Station.	County.	Above Sea. Feet.	Authority.
Alston	Cumberland	1145	T. W. Dickinson.
Ashburton (Druid)	Devon	584	F. Amery.
Aspley Guise, Woburn	Bedford	433	E. E. Dymond, J.P., F.M.S.
Beacon Stoop	Stafford	1216	C. L. Wragge, F.M.S.
Belper	Derby	344	J. Hunter, Jun., F.M.S.
Blackburn	Lancashire	513	W. B. Bryan, M.Inst.C.E., F.M.S.
Blackpool	Lancashire	31	C. T. Ward, F.M.S.
Bridgetown, Totnes	Devon	107	T. H. Edmonds, F.M.S.
Burghill, Hereford	Hereford	275	T. A. Chapman, M.D.
Cardiff	Glamorgan	43	W. Adams, Assoc.M.Inst.C.E., F.M.S.
Chester	Cheshire	65	A. O. Walker, F.L.S., F.M.S.
Cockermouth	Cumberland	144	H. Dodgson, M.D., F.M.S.
Colwyn Bay	Denbigh	180	A. O. Walker, F.L.S., F.M.S.
Cranleigh	Surrey	225	J. Bryan.
Cromer	Norfolk	90	J. Cooper, F.R.C.S.
Cullompton	Devon	202	T. Turner, J.P., F.M.S.
Eastbourne	Sussex	24	S. Bretton, F.M.S.
Farley	Stafford	638	C. L. Wragge, F.M.S.
Guernsey	Channel Isles	180	F. E. Carey, M.D., F.M.S.
Harestock, Winchester	Hants	304	Lt. Col. H. S. Knight, F.R.A.S., F.M.S.
Hodsock, Worksop	Notts	56	H. Mellish, F.M.S.
Ilfracombe	Devon	25	E. J. Slade-King, M.D.
Isleworth	Middlesex	68	Miss E. A. Ormerod, F.M.S.
Kenilworth	Warwick	290	F. Slade, Assoc.M.Inst.C.E., F.M.S.
Limavady	Londonderry	65	W. B. Fawcett, F.M.S.
Loughborough	Leicester	169	W. Berridge, F.M.S.
Maker, Devonport	Cornwall	290	Rev. P. H. Newnham, M.A., F.M.S.
Oakamoor	Stafford	350	C. L. Wragge, F.M.S.
Portsmouth	Hants	20	R. E. Power, L.R.C.P., F.M.S.
Ross	Hereford	213	H. Southall, F.M.S.
Scarborough (St. Nicholas)	Yorkshire	161	J. McClelland.
Sidmouth	Devon	186	W. T. Radford, M.D., F.M.S.
Somerleyton	Suffolk	50	Rev. C. J. Steward, M.A., F.M.S.
Southampton, (Highfield)	Hants	140	Rev. H. Garrett, M.A., F.M.S.
St. Michaels-on-Wyre	Lancashire	26	Rev. P. H. Hornby.
Stapleton	Cumberland	400	T. H. Walker, L.R.C.P., F.M.S.
Swarraton, Alresford	Hants	310	Rev. W. L. W. Eyre, M.A., F.M.S.
Teignmouth (Bitton)	Devon	50	W. C. Lake, M.D., F.M.S.
,, (Woodway)	Devon	285	G. W. Ormerod, M.A., F.M.S.
Throcking, Buntingford	Herts	484	Rev. C. W. Harvey, M.A., F.M.S.
Torquay (Castle College)	Devon	166	C. J. Harland, F.M.S.
,, (Rocombe)	Devon	400	H. Hearder, F.M.S.
Tunbridge	Kent	99	W. C. Punnett, F.M.S.
Tunbridge Wells	Kent	500	F. Green, M.A., F.M.S.
Ventnor	Isle of Wight	80	J. Codling.
Watford	Herts	228	J. Hopkinson, F.L.S., F.M.S.
Weston-super-mare	Somerset	20	W. E. Perrett.
Worthing	Sussex	21	W. J. Harris, M.R.C.S., F.M.S.

Notes on the Tables on pages 44 and 45.

The observations at the Climatological Stations are taken *once* daily, viz. at 9 a.m. The Minimum Temperature is entered to the morning on which it is read, while the Maximum Temperature and the Rainfall are entered to the *previous* day.

Report on the Meteorology of England for the Quarter ending DECEMBER 31ST, 1880, *with Monthly and Yearly Abstracts of Observations made at the Society's Second Order and Climatological Stations.* By WILLIAM MARRIOTT, F.M.S., Assistant-Secretary.

ATMOSPHERIC PRESSURE was below the average and subject to considerable oscillation.

In *October* the mean pressure, reduced to sea level, was 29·91 ins. The highest readings were in the north-west, and the lowest in the south-east. The maximum occurred in the north on the 11th, and in the other districts on the morning of the 14th, the highest being 30·485 ins. at Cheltenham. The minimum took place on the morning of the 28th, the lowest readings reported being 28·698 ins. at Babbacombe at 7 a.m., and 28·711 ins. at Scarborough at 9 a.m.

In *November* the mean pressure was 29·94 ins. The highest readings were in the south, and the lowest in the north. The maximum occurred in the north on the 21st, and in the other districts on various dates; the highest being 30·545 ins. at 9 a.m. on the 21st at Buxton. The minimum took place at most stations on the 16th, except in the south, where it was recorded on the 18th; the lowest reading was 28·440 ins. at 9 a.m. on the 16th at Llandudno.

In *December* the mean pressure was 29·91 ins., and varied considerably, the readings being much higher in the south-west than in the north. The maximum readings occurred on the 7th, the highest being 30·680 ins. at 11 a.m. at Babbacombe. The minimum took place in the west on the 23rd or 24th and in the other districts on the 29th, the lowest being 28·860 ins. at 9 p.m. on the 29th at Scarborough.

AIR TEMPERATURE was about the average.

In *October* the mean temperature* was 44°·4, and varied from 49°·0 at Ramsgate, 47°·9 at Lowestoft, and 47°·8 at Babbacombe, to 40°·9 at Buxton, and 41°·4 at Churchstoke. The weather was cold, wet and stormy throughout the month. Low temperatures prevailed generally from the 20th to the 25th. The maximum temperature occurred mostly on the 1st, except in the south-east, where it was recorded on the 4th and 5th. The highest readings were 68°·1 at Bridgetown, and 67°·2 at Marlborough on the 1st, and 67°·7 at Portsmouth on the 4th. The minimum temperature took place on various dates, chiefly on the 20th, 22nd, 24th, and 25th, the lowest readings being 18°·4 at Buxton and 19°·5 at Blackburn on the 20th, 18°·8 at Alston, and 19°·5 at St. Michael's-on-Wyre on the 22nd, and 21°·0 at Leaton on the 24th. The mean daily range of temperature was 18°·0.

* The mean of the 9 a.m. and 9 p.m. readings.

In *November* the mean temperature was 41°·3, and varied from 44°·8 at Babbacombe, 44°·6 at Llandudno, and 43°·7 at South Bourne, to 38°·6 at Buxton, and 38°·9 at Alnwick and Scaleby. The weather during this month was generally fine and mild. The maximum temperature occurred generally on the 18th. The highest readings were 62°·7 at Hodsock, 60°·9 at Colwyn Bay, 60°·7 at Burghill, and 60°·6 at Oakamoor. The minimum temperature took place mostly between the 20th and 23rd. The lowest readings were 6°·9 at Alston and 14°·5 at Leaton on the 21st, and 12°·4 at Buxton on the 22nd. The mean daily range of temperature was 12°·0.

In *December* the mean temperature was 41°·1, and varied from 44°·8 at Babbacombe, 44°·7 at South Bourne, and 43°·5 at Llandudno, to 37°·8 at Buxton, and 38°·0 at Alnwick and Scaleby. The weather throughout the month was mild and damp, and at some places dull and gloomy. The maximum temperature occurred generally in the north on the 6th, and in the other districts on the 10th. The highest readings were 58°·8 at Hodsock and 56°·6 at Loughborough on the 6th, and 57°·5 at Teignmouth and 57°·2 at Bridgetown on the 10th. The minimum temperature took place on various dates, but chiefly on the 17th, 22nd, 26th and 31st. The lowest readings were 18°·5 at Leaton on the 17th, 14°·9 at Buxton on the 21st, and 5°·9 at Alston and 16°·0 at Stapleton on the 31st. The mean daily range of temperature was 9°·9.

Rainfall was in excess of the average.

In *October* the rainfall from the 4th to the 9th, and from the 25th to the 28th, was exceptionally heavy, falls exceeding 2 inches occurring on two or three occasions. The monthly falls varied from 9·89 ins. at Bridgetown, 9·78 ins. at Ashburton, 9·70 ins. at Ramsgate and 9·06 ins. at Dartmoor, to 1·38 in. at Scaleby, 1·52 in. at Stapleton and 1·82 in. at Cockermouth. On the 4th, falls exceeding 1 inch occurred at nearly all places except in the north, east, and south-east. The greatest amounts measured were, 2·44 ins. at Babbacombe, 2·30 ins. at Torquay, 2·10 ins. at Ross, and 1·88 in. at Bridgetown. On the 5th heavy rain occurred in the north, the greatest fall being 1·59 in. at Scarborough. On the 9th the rainfall was very heavy in the south-east, the greatest falls being 2·57 ins. at Tunbridge, 2·19 ins. at Tunbridge Wells, 2·18 ins. at Croydon and 1·95 in. at Ramsgate. Rain fell heavily in the south and west on the 26th, and over the whole of the northern half of England on the 27th; the largest amounts measured on the 26th were 2·00 ins. at Dartmoor, 1·46 in. at Churchstoke, 1·45 in. at Cardiff, and 1·44 in. at Burghill, and on the 27th 2·38 ins. at Buxton, 2·35 ins. at Colwyn Bay, 2·23 ins. at Llandudno, 2·18 ins. at Wakefield, and 2·06 ins. at Leaton. Thunderstorms occurred in the south on the 7th and 8th. Snow fell at several places from the 19th to the 21st, and from the 26th to the 29th.

In *November* the monthly falls varied from 10·78 ins. at Dartmoor, 7·08 ins. at Ashburton, and 6·72 ins. at Stapleton, to 1·71 in. at Weston-super-Mare, 1·79 in. at Burghill, and 1·88 in. at Aspley Guise. The greatest daily falls were 2·67 ins. at Ventnor, 1·68 in. at Eastbourne, and

1·45 in. at Ramsgate on the 18th. Snow occurred at several places from the 15th to the 23rd.

In *December* the rainfall was very irregularly distributed over the country. The monthly falls varied from 10·46 ins. at Dartmoor, 8·63 ins. at Buxton, 7·91 ins. at Blackburn, and 6·83 ins. at Carmarthen, to 2·00 ins. at Aspley Guise, and 2·07 ins. at Lowestoft and Ramsgate. The greatest daily falls occurred generally on the 19th, 22nd, and 29th, the largest amounts being 1·66 in. at Alston, and 1·46 in. at Alnwick on the 29th, and 1·47 in. at Eastbourne and 1·48 in. at Dartmoor on the 19th. Snow fell almost daily in some part of the country from the 14th to the 31st.

WIND.—In *October* the wind was strong in force, and chiefly from the NE till the 26th, and was variable in direction during the remainder of the month. Heavy gales occurred at many stations. In *November* the general direction of the wind was E from the 1st to the 5th, W or SW from the 6th to the 17th, E or variable from the 18th to the 22nd, and W or SW from the 23rd to the end of the month. Gales were frequent, those on the 13th, 16th, 25th, and 26th, being very severe. In *December* the direction of the wind was chiefly from the W and SW. Strong winds and gales were felt on several occasions.

AURORÆ were seen at many stations in different parts of the country on November 3rd, and in the north on the 20th, 21st, and 27th.

NOTES BY THE OBSERVERS.

BABBACOMBE, *October*.—This has been a very wet, cold and stormy month, except from the 12th to the 18th, and on the last three days, which were fine. The total rainfall, 8·74 ins., was more than double the average, and was the greatest monthly fall since December 1876. The extraordinary fall of 2·44 ins. on the 4th was the greatest daily fall observed in this locality for at least 16 years past. The mean temperature was more than 10° lower than that of the previous month. The mean sea temperature was 56°·3.

November.—Though the temperature, rainfall and barometric pressure were about the average, the weather was very variable. There were no fogs; but some very fine sunny days, especially the 3rd, 4th, 17th, 20th, and 27th. The mean sea temperature was 51°·3.

December.—This has been a mild, damp and gloomy month. Roses, violets, and primroses were in bloom after the 10th. Parhelia were seen on the 2nd. The mean sea temperature was 50°·1.

BUXTON, *October*.—On the 19th, the leaves began to fall; on the 22nd, the leaves of the limes and sycamores had nearly all fallen; and by the 26th, most of the trees were leafless.

CHELTENHAM, *October*.—A month of very great atmospheric disturbance.

Sharp frosts occurred on the 21st, 24th, and 30th. Sleet fell on the 26th. All beans, marrows, and geraniums, killed by frost on the 3rd.

December.—A dull, damp month, especially the latter part, with high mean temperature and low atmospheric pressure. Snow fell on seven days, but never more than a sprinkling, quite insufficient to cover the ground. In consequence of the mild temperature the roses, lilacs, and clematis are putting out their spring leaflets, and much damage will be done if frost does not soon check them.

CHURCHSTOKE, *November*.—Wheat has been put in under favourable circumstances, and the early sown has come up strong and well. Mangolds and a good bulk of the turnip crop have been housed and secured. Cattle as well as sheep have got much keep off the pastures, and winter supply should now be plentiful.

December.—Stock are doing well, but there is some complaint of sheep-rot. Roots were well secured, and appear to be keeping pretty well. Wheat strong and healthy.

COCKERMOUTH, *October*.—A cold dry month, characterised by a prevalence of N and E winds. The driest October at this station during 18 years, and also the coldest.

CROYDON, *October*.—On the 20th, snow began to fall about 8 a.m. and continued without intermission until 1 p.m.; depth on grass, 3 ins., and on gravel path, 1 in. Very few of the large oak and elm trees in this neighbourhood escaped without the loss of one or more of their branches, many of these being over 30 feet in length. Nearly all the heavy rains of this month came with NE winds. All my dahlias were killed by the frost of the 21st, or more than three weeks earlier than in 1879.

November.—Was remarkable for its great freedom from fog, for the low atmospheric pressures recorded on the 16th and 18th, and generally, for its singularly variable character. At mid-day on the 21st the atmosphere was so obscured by fog that houses became invisible at a distance of 30 yards. At the beginning of the month many deciduous trees still retained nearly the whole of their foliage, but the sharp frost of the 2nd caused the leaves to fall from them in unusually large numbers, and it was then remarkable to see the ground under, for instance, such trees as the almond, chestnut, ash, &c., thickly strewn with leaves which were still perfectly green. The last rose of the year was gathered on the 18th.

December.—Was remarkable for its great freedom from fog and the frequent and heavy rains of the last 19 days, but more especially for the extremely variable character of its weather generally. On nearly half the days of the month the velocity of the wind at some time attained to or exceeded 18 miles in the hour. Throughout the whole of the first 13 days the wind at no time blew from any point on the eastern half of the compass.

DOWNSIDE, *October*.—18th, last swallow seen. 25th, martins last seen. Walnut stripped of leaves. 27th, beech stripped.

HILLINGTON, *October*.—A wet sunless month, far below the average of

October in pleasantness. Rainfall 2·57 ins. in excess of mean of 14 years 1866-79.

November.—Altogether a mild and pleasant month.

MAKER, *October.*—No snow or sleet here. Dartmoor covered with snow, down to about 900 ft. level, from 21st to 27th.

ROSS, *October.*—Coldest October I have registered since I began observing in 1858, probably coldest since 1842.

SCARBOROUGH, *October.*—The air temperature has been 2° below the average. The mean sea temperature was 52°·6.

November.—The mean sea temperature was 47°·1, or about 4° warmer than that of the air.

December.—The month has been mild with but little frost or snow, being 2°·1 warmer than the average, and in marked contrast with the exceptionally severe weather we experienced during the corresponding period last year. Mean sea temperature 44°·4.

Duration of Bright Sunshine.

	October. hours.	November. hours.	December. hours.
Churchstoke	71	65	39
Croydon	52	60	25
Hillington	48	41	36
Kelstern	85	66	46
Llandudno...............	60	—	27
South Bourne-on-Sea	78	69	34

Temperature of the Soil.

Observations at 9 a.m.

	Depth below the Surface.	October.	November.	December.
		°	°	°
Babbacombe.........	1 ft.	52·8	46·4	45·9
Beacon Stoop	1 ,,	45·2	39·6	38·8
,, ,, ...	2 ,,	46·2	40·4	39·4
Croydon	1 ,,	50·0	42·8	42·5
Farley	1 ,,	47·6	40·5	39·7
,, ...	2 ,,	48·8	42·0	41·1
,, ...	3 ,,	50·4	44·1	42·5
,, ...	4 ,,	51·5	45·6	43·6
Isleworth	1 ,,	49·7	41·5	42·0
,, ...	2 ,,	52·5	44·4	43·7
Lowestoft...........	1 ,,	50·3	43·2	41·6
Norwood	1 ,,	50·0	41·5	41·9
Oakamoor	1 ,,	49·8	42·6	39·8
,, ...	2 ,,	52·2	45·3	41·1

List of Second Order Stations.

Station.	County.	Lat.	Long.	Above Sea. Feet.	Authority.
Alnwick	Northum.	55° 25′ N.	1° 42′ W.	218	J. Lingwood, F.M.S.
Babbacombe	Devon	50 29	3 31 W.	293	E. E. Glyde, F.M.S.
Buxton	Derby	53 14	1 54 W.	987	E.J.Sykes,M.B.,F.R.A.S., F.M.S.
Carmarthen	Carmarthen	51 52	4 18 W.	188	G. J. Hearder, M.D.
Cheadle (Tean)	Stafford	52 58	1 57 W.	646	J. C. Philips, J.P., F.M.S.
Cheltenham	Gloucester	51 54	2 3 W.	184	R. Tyrer, B.A., F.M.S.
Churchstoke	Montgomery	52 31	3 5 W.	549	P. Wright, F.C.S., F.M.S.
Croydon (Addiscombe)	Surrey	51 23	0 4 W.	201	E. Mawley, F.M.S.
Dartmoor (Prince Town)	Devon	50 33	3 59 W.	1360	W. H. Tooker.
Downside, Stratton on the Fosse	Somerset	51 15	2 29 W.	592	Rev. T. L. Almond, O.S.B., F.M.S.
Hillington	Norfolk	52 48	0 33 E.	88	Rev. H. E. B. Ffolkes, M.A., F.M.S.
Kelstern	Lincoln	53 24	0 7 W.	388	D. G. Briggs, F.M.S.
Leaton	Salop	52 45	2 57 W.	266	Rev. E. V. Pigott, M.A., F.M.S.
Llandudno	Carnarvon	53 21	3 50 W.	79	J. Nicol, M.D., F.M.S.
Lowestoft	Suffolk	52 29	1 45 E.	85	S. H. Miller, F.R.A.S., F.M.S.
Mansfield	Notts	53 8	1 12 W.	349	W. Tyrer, F.M.S.
Marlborough	Wilts	51 25	1 43 W.	471	Rev. T. A. Preston, M.A., F.M.S.
Norwood	Surrey	51 26	0 6 W.	184	W. Marriott, F.M.S.
Ramsgate	Kent	51 20	1 25 E.	105	Rev. T. E. Egan, O.S.B.
Scaleby	Cumberland	54 58	2 52 W.	111	R. A. Allison, F.M.S.
Scarborough	Yorkshire	54 17	0 23 W.	130	F. Shaw, F.M.S.
South Bourne-on-Sea	Hants	50 44	1 48 W.	90	T. A. Compton, B.A., M.D., F.M.S.
Strathfield Turgiss	Hants	51 20	1 0 W.	195	Rev. C. H. Griffith, B.D., F.M.S.
Wakefield	Yorkshire	53 41	1 30 W.	96	H. Clarke, L.R.C.P., F.M.S.

Notes on the Tables on pages 54, 56, 58 and 60.

Column 1 is the mean of the readings of the Barometer at 9 a.m. and 9 p.m. corrected for temperature and reduced to sea-level.

Column 4 is the mean of the readings of the Dry-Bulb Thermometer at 9 a.m. and 9 p.m.

Columns 5 to 10. The Maximum and Minimum Thermometers are read and set at 9 p.m., and the readings entered to the same day.

Columns 13 and 14. The Relative Humidity is calculated by dividing the elastic force of vapour, at the temperature of the dew-point, for the month, by that at the temperature of the air (*i.e.* dry-bulb reading).

Columns 15 and 16. The Amount of Cloud is estimated according to the scale 0—10, 0 representing a cloudless sky, and 10 a completely covered or overcast sky.

Columns 17 to 20. The Rain is measured at 9 a.m., and the amount entered to the previous day. A fall of ·006 in. and above constitutes a day of *rain*.

Column 21. When any Snow falls it is entered as a day of *snow*.

Columns 22 and 23. When the mean of the 9 a.m. and 9 p.m. observations of the amount of Cloud is less than 2·0, this is called a day of *clear sky*, but when the mean is above 8·0 it is called an *overcast* day.

Column 24. When the Force of the Wind is 7 and above (on the scale 0—12) this is counted as a *gale*.

Columns 25 to 33 give the sums of the observations of the Direction of the Wind at 9 a.m. and 9 p.m.

Abstract of Meteorological Observations for the Month of OCTOBER, 1880.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature. 9 a.m.	Air Temperature. 9 p.m.	Air Temperature. Mean.	Means of Min.	Means of Max.	Absolute Min.	Date.	Absolute Max.	Date.	Wet Bulb Therm. 9 a.m.	Wet Bulb Therm. 9 p.m.	Relative Humid. 9 a.m.	Relative Humid. 9 p.m.	Amount of Cloud 9 a.m.	Amount of Cloud 9 p.m.	Rainfall. Total Fall.	Greatest Fall in 24 hours. Amnt.	Greatest Fall in 24 hours. Date.	Weather, No. of days of Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	Wind, No. of Observations of N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Alnwick	29·941	44·0	42·1	43·1	38·5	50·9	24·6	22	63·6	1	42·0	40·6	84	88	7·8	5·4	3·95	·93	27	19	5	1	13	1	8	10	0	0	0	3	12	13	16
Scaleby	·950	42·4	41·0	41·7	35·2	51·0	22·0	22	62·0	1	41·7	40·6	94	96	6·3	6·2	1·38	·43	27	13	1	7	15	4	15	11	1	0	0	6	7	1	21
Scarborough	·901	47·3	46·5	46·9	42·8	50·9	33·4	20	61·3	1	44·4	43·7	79	80	7·8	6·6	6·12	1·84	27	21	2	1	16	4	9	17	10	0	0	5	12	9	0
Wakefield	·929	44·0	42·9	43·5	37·7	50·7	23·4	22	61·8	1	42·0	41·0	84	85	6·8	6·5	5·75	2·18	27	16	2	3	12	1	20	9	2	1	1	4	20	5	0
Kelstern	·905	44·5	42·4	43·4	38·0	50·9	27·5	20	60·9	1	42·9	41·4	87	92	6·9	5·5	6·38	1·64	27	19	3	4	13	0	7	15	3	0	1	8	8	16	4
Mansfield	·918	43·4	41·5	42·5	37·0	49·9	23·5	24	61·5	1	42·1	40·6	90	92	7·4	5·7	5·86	1·59	27	18	3	4	14	0	9	16	5	0	1	8	13	4	6
Buxton	·956	42·2	39·6	40·9	34·0	48·0	18·4	20	59·6	1	40·4	38·6	86	92	7·4	5·7	5·98	2·38	27	19	5	2	11	0	2	10	14	7	0	0	5	19	5
Cheadle	·918	42·7	41·6	42·1	37·6	48·9	27·1	30	60·9	1	41·0	40·2	87	89	7·6	5·5	4·07	1·40	27	14	3	2	11	7	12	19	11	1	0	3	7	3	6
Llandudno ..	·944	46·9	46·5	46·7	41·7	51·1	30·0	22	63·3	1	44·5	44·3	82	84	7·3	6·1	5·01	2·23	27	13	2	2	13	10	2	3	30	4	0	7	12	4	0
Leaton	·940	42·2	41·2	41·7	35·2	49·4	21·0	24	65·8	1	40·9	40·1	89	91	7·1	5·5	5·77	2·06	27	14	1	2	12	..	16	12	11	3	1	0	11	1	7
Churchstoke..	·945	41·5	41·3	41·4	35·4	48·9	22·4	20	65·8	1	40·2	39·9	89	88	6·8	6·3	5·51	1·84	27	11	2	3	12	0	6	7	10	7	2	2	7	12	9
Cheltenham	·906	44·6	42·5	43·6	35·7	51·7	21·6	24	64·8	1	43·3	41·5	90	92	8·0	6·6	4·75	1·68	4	17	1	2	16	0	4	2	13	1	6	2	4	7	23
Carmarthen ..	·903	45·9	43·9	44·9	38·4	53·6	22·8	21	66·6	1	43·6	42·4	83	88	6·4	5·8	4·68	1·44	4	13	1	5	12	0	5	14	21	1	1	2	5	1	12
Dartmoor	·900	42·8	41·3	42·0	37·4	47·9	27·0	22	57·4	5	41·7	40·6	91	94	7·9	7·5	9·06	2·00	26	18	3	4	19	2	1	8	19	6	0	1	10	4	13
Babbacombe..	·878	49·0	46·5	47·8	42·2	54·5	30·6	25	65·5	1	46·6	44·6	83	86	7·5	6·9	8·74	2·44	4	16	1	5	18	8	7	18	10	2	1	9	9	4	2
Downside	·899	44·3	43·3	43·8	38·8	51·6	27·4	24	63·9	1	43·3	42·0	92	90	7·6	5·9	5·84	1·45	6	18	1	4	15	5	5	18	9	1	3	12	7	5	2
Marlborough	·907	44·7	42·6	43·7	37·7	53·0	26·0	21	67·2	1	43·3	41·5	89	91	7·3	5·3	5·50	1·21	4	17	1	4	11	0	6	6	8	3	4	0	6	1	28
Strathfield T.	·900	47·0	43·8	45·4	38·7	54·0	27·2	24	66·9	1	45·3	42·7	87	91	8·1	6·5	4·74	·77	26	18	2	1	17	0	5	18	8	4	3	7	3	6	8
Norwood	·893	45·7	45·1	45·4	40·2	53·2	29·0	30	65·4	7	44·4	43·6	90	88	8·1	6·4	7·21	1·68	9	21	2	2	15	4	9	10	7	0	4	1	9	3	19
Croydon	·896	45·8	44·3	45·0	39·6	53·1	29·3	24	66·1	5	44·4	43·0	89	90	8·3	5·5	7·65	2·18	9	21	1	4	14	0	3	16	5	0	2	8	10	2	16
South Bourne	·884	47·4	46·0	46·7	40·6	54·1	28·9	21	64·8	2	45·5	44·1	86	86	6·9	5·5	5·59	1·02	26	18	1	8	15	5	14	18	10	1	1	4	5	5	4
Ramsgate	·887	49·9	48·2	49·0	43·4	54·8	32·5	25	66·1	5	48·7	47·3	91	93	8·5	7·3	9·70	1·95	9	20	0	2	17	1	0	19	3	0	10	6	6	3	15
Hillington ..	·880	46·6	43·3	45·0	38·1	53·3	25·9	24	61·9	5	45·1	42·2	88	91	8·0	5·8	4·73	·74	4	15	0	2	12	0	4	17	8	4	1	8	6	14	0
Lowestoft	29·857	48·4	47·4	47·9	42·2	53·7	31·6	25	63·1	5	46·0	45·1	83	83	7·8	6·1	3·64	·85	6	21	0	4	16	3	7	7	14	2	2	3	13	14	0
Columns ..	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Alnwick	●	✱▲	●✱	●≡	●▲	●▲	●≡	●≡	●▲	≡	●	≡	...	≡	...	...	...	●	✱▲	●✱▲	●✱▲	●	●≡	≡	●▲	●▲	●	●▲	●▲	...	...
Scaleby	...	...	...	●	●	...	●	...	●	...	...	...	...	...	...	...	≡	●	...	●✱	...	...	...	●	●	...	●	●	●	●	●
Scarborough	●	●	●	●	●	●	●	...	●	●	●	...	≡	≡	≡	≡	≡	●	●✱▲	●✱▲	●	●▲	▲	...	●	●	●	●	●▲	...	●
Wakefield	●	●	...	●	●	●	●	...	...	...	...	...	...	...	...	...	...	●	...	●✱	...	●	Ψ	...	●	●	●✱	●	●	●	●
Kelstern	...	●	...	●	●	●	●	●	●	●	●	●	...	...	...	...	≡	●≡	...	●✱	●✱	●≡	...	...	...	●	●	●	●✱	...	●
Mansfield	●	●	...	●	●	●	●	●	●	...	...	●	≡	...	...	...	≡	●	✱	●	✱	●Ψ	...	●	...	●≡	●	●	✱	●	●
Buxton	●	●	...	●≡	●	●	●	●	...	...	...	●	...	...	...	≡	●	●	...	...	✱	●Ψ	●	●	●	●✱	●✱	●✱	✱	●	●
Cheadle	●	●≡	...	●	●	●	●	...	...	...	...	...	...	...	...	...	≡	●	✱	...	...	●▲	...	●	●	●	●	●✱	✱	...	●
Llandudno	●≡	●	●▲	●≡	●	●	≡	●≡	...	...	...	...	...	...	...	...	≡	●	...	●✱	...	...	...	●	...	●	●✱ꓘ	...	...	...	●
Leaton	●	●	●	●	●	●	●	≡	...	...	...	...	...	...	≡	≡	≡	●	...	✱	●	...	...	●	●	●	●	●	...	...	...
Churchstoke	...	●	●▲	●	●	●≡	●≡	●≡	...	...	...	...	...	...	...	≡	...	...	...	...	...	...	...	...	●	●✱	●✱	●≡	...	...	...
Cheltenham	...	●	...	●	●	●	●	●	●	...	●	...	...	...	...	...	...	●≡	●	...	Ψ	●	...	...	●≡	●✱	●	●	●	...	●
Carmarthen	...	●	●	●	●	●	●<	<	...	...	...	...	...	...	≡	...	●	≡	...	✱	Ψ	...	..	●	●	●▲	●	●	...	...	●
Dartmoor	...	●	●	●	●≡	●≡	●	●	●	●≡	...	...	...	...	...	...	...	...	●	✱	●○	●✱	✱	...	●	●≡	●≡	●	...	●	●
Babbacombe	...	●	●	●	...	●	●ꓘ	●ꓘ	●	●	...	...	...	...	...	...	...	...	●	✱○≡	●○	●	●	...	●	●≡	●	●▲	<	...	...
Downside	...	●	...	●	●	●	●ꓘ	●≡	●	●	...	●≡	≡	...	≡	≡	...	...	●	✱	...	●	●	●	●	●	●≡	●	...	●	...
Marlborough	...	●	...	●	●	●	●	●	●	●	...	●	...	Ψ	...	...	...	●≡	●	✱	●	●	...	...	●	●	●	●	...	...	...
Strathfield Turgiss	≡	●○	...	●≡	●	●	<	●	●	●	●	●	...	≡	≡Ψ	≡	...	≡	●✱	●✱Ψ	●○	●	...	...	●	●	●≡	●	○	...	●
Norwood	≡	●	...	●≡	●	●≡	●	●T○	●	●	●	●≡	...	≡	≡Ψ	≡	≡	●≡	●	●✱Ψ	●✱○	●	●	≡	●	●	●≡	●	○	≡	●
Croydon	≡	●	...	●	●	●	●	●ꓘ	●	●	●	●	...	≡	≡	≡	≡	●	●	●✱	●	●	●	≡	●	●	●≡	●	...	●≡	...
South Bourne-on-Sea	...	●	●	●	●	●	●	●	●	●	...	...	...	...	...	...	...	...	●	●✱	●	●	●	...	●	●	●	●	...	...	...
Ramsgate	...	...	●	●	●	●	●	●	●	●	●	●	●	...	...	●	...	...	●	●	●	...	●	...	...	●	●	●	●	...	...
Hillington	...	●	...	●	●	●	●	●	●	...	...	●	...	...	...	...	...	...	...	●▲	●▲	●	...	...	...	●	●	●	●▲	...	...
Lowestoft	...	●	●	●	●	●	●	●	●	●	●	●	●	...	...	...	...	●	●	●	●	...	●	...	...	●	●	●	●	...	...

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; ꓘ thunderstorm; T thunder; < lightning; ○ solar halo; Ψ lunar halo.

Abstract of Meteorological Observations for the Month of NOVEMBER, 1880.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature. 9 a.m.	Air Temperature. 9 p.m.	Air Temperature. Mean.	Means of Min.	Means of Max.	Absolute Min. and Max. Min.	Date.	Max.	Date.	Wet Bulb Therm. 9 a.m.	Wet Bulb Therm. 9 p.m.	Relative Humid. 9 a.m.	Relative Humid. 9 p.m.	Amount of Cloud. 9 a.m.	Amount of Cloud. 9 p.m.	Rainfall. Total Fall.	Greatest Fall in 24 hours. Amnt.	Greatest Fall in 24 hours. Date.	Weather, No. of days of Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	Wind, No. of Observations of N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Alnwick......	29·817	38·9	39·0	38·9	33·8	46·9	16·9	21	58·5	13	37·5	37·4	88	87	6·8	4·4	4·00	·81	14	19	8	4	9	0	3	2	0	4	4	15	11	3	18
Scaleby......	·836	38·5	39·3	38·9	32·7	46·0	16·0	20	57·2	13	37·3	37·8	90	88	6·6	5·8	3·64	·48	13	19	2	6	13	10	1	3	7	1	1	30	3	0	14
Scarborough..	·857	43·6	43·0	43·3	38·2	47·7	27·3	23	58·3	13	41·2	40·8	81	83	6·6	4·9	2·31	·69	17	18	5	3	7	0	5	6	3	1	6	17	15	7	0
Wakefield....	·895	41·8	41·3	41·5	35·3	48·3	20·9	22	59·4	13, 14	39·8	39·5	84	85	6·8	6·6	1·96	·63	17	16	0	2	12	0	6	1	0	3	7	13	22	8	0
Kelstern	·916	40·3	39·2	39·8	34·3	46·8	22·2	22, 23	57·7	13	39·1	38·3	90	92	5·7	4·6	3·48	·90	14	20	8	6	7	0	4	6	0	1	5	20	8	16	0
Mansfield	·919	39·7	39·0	39·3	34·3	46·9	20·8	21	58·5	13	38·4	38·1	89	92	6·5	4·4	2·91	1·28	14	16	4	4	7	0	8	3	2	0	6	20	11	5	5
Buxton	·950	38·5	38·7	38·6	32·0	45·3	12·4	22	56·2	13	37·4	37·4	91	89	7·0	7·0	5·83	1·27	13	18	9	1	12	0	3	9	3	1	0	3	18	18	5
Cheadle......	·925	39·6	39·8	39·7	34·8	46·6	21·4	22	56·4	13	38·3	38·6	89	90	5·9	5·4	3·01	1·22	14	19	6	6	10	8	5	6	3	1	6	15	6	11	7
Llandudno ..	·885	44·7	44·5	44·6	38·6	49·1	25·7	22	57·3	13	42·3	42·2	82	82	6·5	5·6	4·28	·70	16	16	1	6	13	3	0	3	6	3	10	7	26	5	0
Leaton	·938	39·7	40·2	40·0	33·5	47·3	14·5	21	58·9	13	38·3	39·0	89	90	..	..	2·61	1·06	14	11	0	..	..	..	6	2	3	0	7	4	24	1	13
Churchstoke..	·949	39·6	40·6	40·1	34·3	47·6	16·1	18	56·8	13	38·0	39·1	87	88	6·0	5·8	3·10	·96	14	14	3	4	9	2	6	4	4	2	1	8	26	6	3
Cheltenham ...	...	41·1	41·0	41·0	34·8	47·4	18·8	22	57·2	14	39·8	39·7	90	89	7·0	5·7	2·98	·93	15	16	1	5	12	0	5	1	1	1	7	11	13	5	16
Carmarthen ..	·943	42·7	43·4	43·0	38·2	49·8	22·7	22	55·7	13	41·2	42·2	88	91	5·9	7·1	4·72	·71	13	18	2	6	13	4	7	0	8	1	2	24	3	3	12
Dartmoor	·997	39·9	40·0	40·0	35·3	44·3	21·0	21	51·7	26	39·1	39·4	93	95	7·8	7·3	10·78	1·39	23	18	2	5	20	1	3	3	14	0	2	16	14	7	1
Babbacombe..	·985	45·3	44·4	44·8	40·4	50·2	29·7	22	57·6	12	43·6	42·8	87	87	7·3	6·4	3·85	·78	25	15	2	5	13	8	7	6	5	1	6	24	6	4	1
Downside	·983	40·7	40·9	40·8	36·0	47·6	20·7	22	55·3	10	39·7	39·9	91	91	6·9	5·4	4·10	·69	15	16	4	5	11	4	3	12	1	2	2	21	15	4	0
Marlborough	·992	40·1	40·3	40·2	35·4	47·6	15·8	22	56·7	13	39·1	39·2	92	91	7·9	5·7	3·25	·70	18	14	3	2	13	0	3	1	1	0	1	7	11	3	33
Strathfield T.	·988	42·1	40·7	41·4	34·7	48·8	21·5	22	57·1	13	40·6	39·3	88	89	6·8	5·7	2·21	·44	14	15	2	5	14	0	7	14	0	1	1	16	14	3	4
Norwood	·985	41·9	41·9	41·9	36·3	48·2	24·2	22	57·7	13	40·2	40·2	86	86	6·9	4·7	2·00	·58	18	12	4	7	13	5	7	1	4	0	4	10	21	5	8
Croydon	·987	41·8	41·6	41·7	36·4	48·3	23·6	2	57·9	13	40·1	39·9	86	86	7·3	4·1	2·39	·60	18	12	2	4	10	0	1	10	0	1	2	23	12	5	6
South Bourne	·994	43·8	43·6	43·7	39·2	49·3	22·1	22	57·1	14	42·2	41·8	87	86	6·4	5·0	3·04	·81	18	15	1	6	9	5	11	5	3	0	5	12	16	7	1
Ramsgate	·993	43·5	43·2	43·4	36·8	48·7	27·5	22	55·7	13	42·6	42·2	93	92	7·1	5·4	4·13	1·45	18	15	2	4	11	5	2	0	4	0	15	10	5	13	11
Hillington.....	·920	41·8	39·8	40·8	34·9	48·0	21·5	22	58·2	13	40·5	38·8	89	92	7·7	6·2	2·65	·88	14	17	5	3	16	2	2	3	3	5	2	26	11	8	0
Lowestoft	29·930	43·3	42·2	42·8	37·7	48·9	27·0	23	58·2	13	41·5	40·3	86	85	7·1	5·4	2·14	·60	15	17	1	3	12	3	2	5	6	1	1	15	23	7	0
Columns	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Phenomena observed at the Stations during NOVEMBER, 1880.

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Alnwick	...	≡	≡	≡	...	...	●≡	▲≡	●✱	●	●	●	●≡	●≡	●	●✱	●✱	●✱▲	●✱▲	✱▲≡	●▲≡	✱▲	●✱	●	●	●<	...	●	...	●≡
Scaleby	...	...	...	...	...	●	●	●	●	●	●	●	●	●▲	●✱	●	●✱	...	...	...	...	...	●	●	●	●	K	●	●	●
Scarborough	...	●	...	≡	...	...	●	...	●	●	...	●	●	●	●	●	●✱	●✱▲	●▲	●✱▲	●▲	✱≡	●✱	●	●	●▲	...	...	...	...
Wakefield	...	...	≡	...	●	...	●	...	●	●	●	●	●	●	●	●	●	...	...	...	...	...	●	●	●	●	...	...	●	...
Kelstern	...	●	●	...	...	...	●	●	...	●	●≡	●	●	●	●✱	●	●✱≡	●✱	●✱	●✱	●✱	✱	●✱≡	●	●	●	...	...	...	...
Mansfield	...	≡	...	≡	≡	...	●	...	●≡	●	●	●	●	●	●✱	●	●	●✱	...	≡	✱≡	≡	●✱	●	●	●	●	...	...	...
Buxton	...	...	...	...	●	●	●	...	●	●	●	●	●	●	●✱	●✱	●✱	✱	...	...	●✱	✱	●✱	●✱	●✱	●	...	...	●	...
Cheadle	...	...	...	≡	●	...	●	≡	●≡	●≡	●	●	●	●	●✱≡	●	●✱	●✱	✱	...	●✱	●≡	●✱≡	●	●	●	●	...	...	...
Llandudno	...	...	...	...	...	●	●	...	●	●	●	●	●	●	●✱	●	●▲K	...	...	...	...	...	...	●	●▲	●▲K	...	●	●	...
Leaton	...	...	...	...	...	...	●	...	...	●	...	●	●	●	●	...	▲	●	...	...	...	≡	...	●	●	●<	●<	...	...	...
Churchstoke	...	...	...	...	...	...	●	...	●	●	...	●	●	●	●✱	●✱	✱	...	...	...	≡	●	●	●	●	●	●▲	...	...	...
Cheltenham	...	...	...	...	●	...	●	...	...	●	●	●	●	●	●	●	...	●✱	...	...	≡	●≡	●	●	●	●	●	...	...	...
Carmarthen	...	...	...	≡	...	...	●	...	●≡	●	●	●	●	●	●	●	●✱	✱	...	≡	...	●	●	●	●	●	●	●	...	●
Dartmoor	...	...	...	...	...	●≡	●≡	...	●	●	●≡	●≡	●≡	●	●≡	●	...	●✱	✱	<	...	●	●≡	●	●	●	●	●	≡	≡
Babbacombe	●○	...	...	...	○	...	●	...	○	●	●	●○	●	●	●Ʊ	●	...	●✱	✱	...	...	●	●	●	●▲	●▲○	...	...	...	...
Downside	...	...	...	●	...	●	●	...	...	●	●	●	●	●✱	●	●	...	●✱	✱	...	≡	●≡	●✱	●	●	●	...	...	...	...
Marlborough	...	...	...	...	...	...	●	...	...	●	●	●	●	●	●	●	...	●✱	✱	...	≡	●≡	●✱≡	●	●	●	...	...	≡	≡
Strathfield Turgiss	...	≡	...	●	≡	...	●	...	...	●	●	●	●	●	●≡	●	...	●✱	≡	≡	≡	≡	●✱	●	●	●	●	...	...	...
Norwood	≡	≡	≡	≡	≡	≡	●	≡	≡	...	●	●Ʊ	●<	●	●≡	●	...	●✱≡	≡○	✱≡	✱≡	≡	●✱≡	●	●▲K	●	...	...	○	...
Croydon	...	...	...	≡	≡	≡	●	≡	...	...	●	●	●	●	●≡	●	≡	●✱	≡	✱≡	≡	...	●	●	●T	●	...	...	...	...
South Bourne-on-Sea	...	...	...	...	...	...	●	...	...	●	●	●	●	●	●	●	●	●✱	...	...	...	●	●	●	●	●	...	...	...	...
Ramsgate	●	●	...	...	...	...	●	...	...	...	●	●	●	●	●	●	...	●	●	●✱▲	✱▲	...	...	●	●	●	...	...	...	...
Hillington	...	●	...	...	●	...	●	●	...	...	●	●	●	●	●	●	...	●	●✱▲	●✱▲	✱	✱	●✱	●	...	●	●	...	...	...
Lowestoft	●	●	...	...	≡	...	●	●	...	...	●	●	●	●	●	●	...	●	●▲	●▲	...	...	●✱	●	●	●	...	...	...	...

EXPLANATION OF THE SYMBOLS.—● indicates rain; ✱ snow; ▲ hail; ≡ fog; K thunderstorm; T thunder; < lightning; ○ solar halo; Ʊ lunar halo.

Abstract of Meteorological Observations for the Month of DECEMBER, 1880.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature. 9 a.m.	Air Temperature. 9 p.m.	Air Temperature. Mean.	Means of Min.	Means of Max.	Absolute Min. and Max. Min.	Date.	Max.	Date.	Wet Bulb Therm. 9 a.m.	Wet Bulb Therm. 9 p.m.	Relative Humid. 9 a.m.	Relative Humid. 9 p.m.	Amount of Cloud. 9 a.m.	Amount of Cloud. 9 p.m.	Rainfall. Total Fall.	Greatest Fall in 24 hours. Amnt.	Date.	Weather, No. of days of Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	Wind, No. of Observations of N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.															
Alnwick	29·756	37·6	38·3	38·0	33·8	42·9	24·6	17	53·3	10	35·9	36·6	85	85	5·5	4·2	4·00	1·46	29	18	9	8	7	3	3	1	0	1	5	9	20	13	10
Scaleby	·802	37·7	38·3	38·0	33·5	43·1	19·2	31	53·2	6	36·3	37·0	88	89	7·2	7·1	3·03	·68	22	22	5	4	18	7	3	7	5	3	0	26	4	3	11
Scarborough..	·803	39·9	41·6	40·7	36·7	44·7	28·5	22, 26	54·0	10	38·4	39·6	88	84	6·3	6·3	2·85	·73	29	18	5	3	10	1	1	2	1	1	6	16	25	10	0
Wakefield	·846	39·1	40·7	39·9	34·6	45·3	23·2	18	55·2	6	37·7	39·0	88	86	7·1	7·4	3·57	·80	22	20	5	1	13	1	5	1	5	1	5	12	29	4	0
Kelstern	·857	37·7	38·7	38·2	34·1	43·7	26·7	27	54·8	6	37·1	38·0	95	94	6·1	5·5	2·64	·48	15	19	7	4	7	1	1	2	2	2	6	16	23	10	0
Mansfield	·885	39·0	39·5	39·3	35·4	44·7	25·2	17	54·5	6	38·0	38·4	92	91	6·6	5·3	3·16	·70	29	18	10	4	12	0	3	0	0	2	4	27	16	7	3
Buxton	·906	38·0	37·7	37·8	31·9	43·5	14·9	21	53·6	6	37·1	36·7	92	91	7·9	6·7	8·63	1·12	22	25	12	1	16	0	1	1	1	4	0	8	15	30	2
Cheadle	·884	38·1	39·2	38·7	34·6	44·0	23·1	26	53·2	6	37·3	38·1	93	91	7·9	6·3	5·12	·91	29	24	6	1	14	10	0	1	3	2	3	14	12	18	9
Llandudno ..	·872	43·6	43·4	43·5	39·6	47·7	29·2	18	54·4	7	41·5	41·5	84	85	7·2	6·5	5·40	1·00	29	20	2	5	16	1	11	0	4	2	3	6	34	2	0
Leaton	·907	40·5	39·6	40·0	33·6	45·7	18·5	17	55·0	10	39·3	38·3	90	89	7·4	5·7	3·83	·90	29	15	4	2	12	..	7	2	1	2	2	5	25	7	11
Churchstoke..	·922	40·4	40·6	40·5	35·5	46·4	23·4	18	53·8	6	39·2	39·2	90	89	7·9	7·4	4·56	·91	29	17	8	0	16	0	2	5	2	3	1	6	21	20	2
Cheltenham ..	....	42·0	41·2	41·6	35·0	47·5	24·0	26	55·0	10	40·8	39·7	90	88	8·2	6·2	2·92	·40	14	17	7	1	14	0	1	0	0	0	8	10	18	8	17
Carmarthen ..	29·933	43·7	43·1	43·4	38·6	48·4	23·4	18	54·5	10	43·0	42·1	94	92	8·3	7·3	6·83	1·07	29	21	1	1	17	0	3	0	6	1	1	16	19	4	12
Dartmoor	30·001	41·7	40·2	40·9	37·2	44·6	27·0	18	49·4	29	41·1	39·7	95	96	9·2	9·3	10·46	1·43	19	23	5	1	27	0	4	4	2	0	3	24	15	10	0
Babbacombe..	29·983	45·1	44·5	44·8	41·0	50·1	30·0	18, 26	55·4	10	43·9	43·2	90	90	8·2	6·9	4·56	·89	19	17	2	1	15	7	2	3	1	2	2	24	23	5	0
Downside	·957	42·4	41·9	42·2	37·5	46·5	29·6	18, 25	54·2	1	41·8	41·1	95	93	8·4	6·5	5·37	·73	14	17	7	2	16	3	0	7	1	0	4	25	20	5	0
Marlborough	·956	41·8	40·8	41·3	36·8	47·3	27·9	26	53·4	10	40·9	39·6	92	90	7·9	6·2	3·92	·84	29	18	5	4	17	0	2	2	2	0	3	1	21	13	18
Strathfield T.	·953	42·8	42·2	42·5	37·5	48·4	27·0	22	54·7	10	41·4	40·6	89	87	7·6	5·7	2·82	·56	29	14	3	3	12	0	2	5	0	3	1	12	29	8	2
Norwood	·944	42·9	42·7	42·8	37·7	48·1	27·7	22	55·7	10	41·6	41·1	89	87	8·3	6·1	2·83	·50	19	19	5	3	15	1	0	3	3	0	3	10	28	8	7
Croydon	·946	43·3	42·9	43·1	38·3	48·6	27·6	22	55·6	10	41·7	41·0	88	85	8·5	5·6	3·18	·76	29	17	7	3	14	0	0	2	2	1	2	20	27	3	5
South Bourne	·973	45·3	44·1	44·7	40·3	49·3	31·9	25	55·0	10	43·8	42·5	88	88	7·3	5·8	4·57	·94	19	19	0	4	10	1	2	3	2	3	0	9	28	13	2
Ramsgate	·948	43·1	43·3	43·2	37·8	48·4	29·5	26	54·8	10	42·3	42·1	94	91	8·5	7·3	2·07	·59	19	12	0	0	18	1	0	1	3	1	7	29	12	0	9
Hillington ..	·868	39·4	40·6	40·0	35·5	45·9	25·4	17	52·9	10, 23	38·3	39·4	90	90	8·2	7·4	2·38	·30	15	21	5	2	20	0	3	1	1	3	3	28	9	14	0
Lowestoft	29·879	40·7	41·4	41·0	36·5	46·5	27·7	3	54·5	10	39·8	40·2	93	90	6·5	6·2	2·07	·26	30	19	3	5	12	1	0	0	3	2	2	11	34	10	0
Columns ..	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

DATE.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Alnwick	●	●≡	●≡	●≡	●	...	...	...	...	...	...	●	...	●*ʊ	●*	●▲≡	▲≡	●*▲	*	●	...	●*≡	●≡	●*≡	*	...
Scaleby	●	...	●	●	●	●≡	●	●	...	...	●	●	●	●	●*	...	...	●*▲	...	●*	●	●	●	...	...	...
Scarborough	...	●	...	≡	●	...	≡	...	...	...	...	●	...	●	●*≡	●▲≡	●≡	●*	*	●	●	●≡	●	...	●*	...
Wakefield	●	●	●	●	●	...	≡	...	...	...	...	●	●	●	●*	...	...	●	●*	...	●	●*	●	...	...	●
Kelstern	●	●	≡	≡	●	●	≡	...	●	...	...	●	...	●	●*	...	●	●*	*	...	●	●*≡	●≡	...	...	●
Mansfield	●	...	●≡	≡	●≡	●	≡	...	...	...	...	...	...	●*	●	...	≡	●*	*	●	●*≡	●*≡	●	●≡	●*	●*
Buxton	...	●	●	●≡	●	●	...	●	●	●	●	●	●	●*	●*	...	...	*	...	●*	●*	●	●	●	●*	●*
Cheadle	●	●	●≡	●≡	●	●	≡	...	●	...	...	●	●	●*	●≡	...	...	●*≡	...	●	●≡	●	●	●	●*	●
Llandudno	●	●	●	...	...	●	...	●	...	...	●	●	●	●	●	...	...	●▲	*	●	●	●	●	●	...	...
Leaton	...	...	●≡	...	●	●	...	...	...	...	...	...	●	●	●	...	≡	●*	*	...	●	●≡	●	...	...	●
Churchstoke	...	...	●	...	●	...	...	●	...	...	...	...	...	●*	●	●≡	≡	●*	●*	●	●	●	●	...	*	●
Cheltenham	...	●≡	...	...	...	...	...	...	...	...	...	...	●	●*	●	...	●*	●*	●	●≡	●	●	●	≡	*	●
Carmarthen	●	●≡	●	...	...	●	...	...	...	...	●	...	●	●	●	...	●	●▲	●	●	●	●	●	...	...	●
Dartmoor	●≡	●≡	≡	●	≡	≡	≡	●≡	●≡	●≡	≡	≡	●	●	●≡	●≡	●*≡	●	●*	●	●	●≡	●	...	...	●
Babbacombe	●○	●≡○	≡	●	...	...	...	...	...	...	ʊ	ʊ	...	●	●	●○	●*	●<	●≡	●≡	●≡	●	●<	<	...	●
Downside	...	...	●	...	...	...	●	...	...	...	●	...	●	●	●	●*	*	●*	●	●≡	●	...	●	...	...	●
Marlborough	●	●≡	≡	...	...	...	...	...	...	...	...	...	●	●	●	●	●*	●	●	●*	●	●	●	...	...	●
Strathfield Turgiss	...	●≡	≡	...	...	...	...	...	...	...	...	...	●	●*▲≡	●	●	...	●	●	●*≡	●≡	●	●	...	...	●
Norwood	●≡	≡	...	...	...	...	●	...	...	...	...	...	●	●	●	●	●*	●	●	●*≡	●≡	●≡	●	●	...	●
Croydon	●≡	≡	≡	...	...	...	≡	...	...	...	≡	ʊ	●	●*	●	●	●*	●*	●	●*	●≡	●	●	...	...	●
South Bourne	●	●	...	●	...	...	●	...	...	...	...	...	...	●	●	●	●	●	●	●	●	●	●	●	...	●
Ramsgate	...	...	●	...	...	...	...	...	...	...	...	...	●	●	●	...	...	...	●	...	●	●	●	...	...	●
Hillington	●	●≡	●≡	●	●	●	≡	...	...	ʊ	...	●	●	●	●*	...	●	●*	...	...	●≡	●	●	...	...	●
Lowestoft	...	...	●≡	≡	...	●	≡	...	...	...	...	●ʊ	●	●	●	...	●	●	●*	●	●≡	●≡	●	...	...	●

EXPLANATION OF THE SYMBOLS.—● indicates rain; * snow; ▲ hail; ≡ fog; ⋉ thunderstorm; ⊤ thunder; < lightning; ○ solar h

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30	31	32	33
111	194	81	16
190	73	110	6
..	..	..	..
106	130	83	33
168	131	27	136
85	174	42	125
144	158	50	42
79	106	38	296
256	102	37	12
165	123	54	16
136	133	73	49
112	105	30	124
70	130	50	179
114	129	107	69
..	..	..	..
88	247	45	0
112	83	103	76
40	185	215	35
181	128	34	43
148	127	90	22
118	198	55	1
147	147	62	7
201	76	14	176
SW.	W.	NW.	Calm.

Observations of

Mean Amount of Cloud at 9 a.m.	Rain. Amount.	No. of Days.
	In.	
7·5	6·55	19
7·5	4·71	16
7·5	4·21	18
8·0	4·05	19
7·2	4·17	19
8·0	4·08	20
7·8	4·72	20
6·3	5·14	17
7·6	5·16	20
6·5	3·96	19
7·2	4·22	17
7·8	5·44	13
7·1	4·21	21
7·7	3·53	14
[illegible]·1	3·32	14
[illegible]·9	3·52	16
[illegible]·3	3·24	16
[illegible]·4	2·93	16
[illegible]·1	3·26	18
[illegible]·5	3·69	17
[illegible]·5	2·00	15
[illegible]·7	2·66	21
[illegible]	2·26	22
[illegible]	2·39	13
	4·95	21
	3·62	22

Abstract of Meteorological Observations for the YEAR 1880.

Station.	Mean of Pressures at 9 a.m. and 9 p.m.	Air Temperature.									Wet Bulb Therm.		Relative Humid.		Amount of Cloud.		Rainfall.			Weather, No. of days of					Wind, No. of					
		9 a.m.	9 p.m.	Mean.	Means of		Absolute Min. and Max.				9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	Total Fall.	Greatest Fall in 24 hours.		Rain, Snow or Hail.	Snow only.	Clear Sky.	Overcast.	Gales.	N.	NE.	E.	SE.	S	Calm.
					Min.	Max.	Min.	Date.	Max.	Date.								Amnt.	Date.											
	In.	°	°	°	°	°	°		°		°	°	o/o	o/o			In.	In.												10 11
Scaleby	29·931	47·3	45·7	46·5	40·1	54·1	16·0	{ Jan. 20 Nov. 20 }	80·7	Sept. 4	45·2	44·3	85	89	6·5	6·0	29·27	1·31	July 13	183	13	55	155	41	41	77	119	16	1	0
Scarborough	·946	48·9	47·7	48·3	43·8	52·8	23·7	Jan. 28	76·3	Aug. 10	46·4	45·7	83	86	7·3	6·1	32·55	1·84	Oct. 27	191	15	31	146	15	110	87	61	51	64	0
Wakefield	·968	48·1	47·2	47·6	41·7	54·9	15·9	„ 28	82·8	Sept. 4	45·6	45·3	83	86	7·5	6·5	37·22	2·18	„ 27	166	9	17	146	7	98	74	82	48	50	0
Kelstern	·975	47·1	44·8	46·0	40·5	53·3	16·9	„ 29	81·3	„ 4	45·2	43·7	86	92	6·9	5·8	37·22	1·87	Sept. 14	180	24	42	126	7	52	121	65	46	67	3
Mansfield	·979	47·1	45·4	46·2	41·0	54·0	17·7	„ 20	77·9	Aug. 10	45·2	44·2	86	91	7·4	5·7	37·42	1·59	Oct. 27	181	25	37	153	0	76	90	86	26	6	
Buxton	....	45·0	44·5	44·7	37·7	....	12·1	„ 28	80·1	Sept. 4	43·5	43·3	88	91	7·5	6·2	37·23	2·38	„ 27	163	31	20	136	0	12	77	129	34		
																														2
Cheadle	·976	45·9	45·5	45·7	40·6	53·2	15·6	„ 29	80·9	„ 4	44·1	44·0	87	89	7·1	5·9	37·37	2·33	Aug. 7	179	19	34	139	68	56	85	129	35	5	9
Llandudno ..	·959	50·1	49·2	49·7	44·8	54·8	24·2	„ 21	81·8	„ 4	47·3	47·0	81	84	6·4	5·4	35·57	2·23	Oct. 27	154	8	69	130	31	66	39	135	64	4	0
Leaton	....	....	....	....	....	....	11·9	„ 27	83·1	„ 4	....	....	....	....	....	....	34·15	2·06	„ 27	176	6	..	..	..	..	..	..	..	.7	11
Churchstoke	·997	46·7	46·0	46·4	40·0	54·2	13·2	„ 20	81·0	„ 3	44·5	44·2	83	86	7·3	6·2	33·61	1·84	„ 27	159	17	19	137	3	43	76	86	66	4	2
Cheltenham ..	....	48·8	47·1	47·9	40·6	55·9	10·0	„ 20	83·5	„ 4	46·5	45·3	84	87	7·4	5·7	33·72	1·68	„ 4	177	13	30	127	1	64	59	52	36	9	17
Carmarthen ..	29·976	50·4	47·9	49·2	42·9	56·6	15·7	„ 22	83·0	„ 4	47·8	46·5	83	89	6·8	5·9	43·60	1·44	„ 4	188	5	58	153	16	78	40	161	32	5	
																														12
Dartmoor ...	30·004	46·1	44·1	45·1	40·3	50·8	15·5	„ 27	73·0	„ 3, 4	....	....	....	....	8·0	7·4	75·85	2·33	Mar. 2	192	16	33	215	9	34	86	143	49	2	0
Babbacombe ..	30·000	50·8	48·7	49·8	44·7	56·4	21·9	„ 28	76·6	Aug. 31	48·4	46·9	84	87	7·3	6·1	37·52	2·44	Oct. 4	178	11	41	152	46	55	148	96	21	5	0
Downside	29·996	47·7	46·4	47·1	41·8	55·1	14·5	„ 28	83·2	Sept. 4	46·0	45·2	88	90	7·5	5·7	43·40	1·45	„ 6	183	16	43	144	22	35	170	56	25	3	0
Marlborough..	30·004	48·1	46·3	47·2	41·2	56·4	8·6	„ 28	84·5	„ 4	45·8	44·7	85	88	7·7	5·6	33·25	1·21	„ 4	180	16	35	155	0	35	68	62	13	3	18
Strathfield T.	·002	50·2	47·1	48·6	41·0	57·6	13·3	„ 26	85·0	„ 4	47·4	45·3	81	87	7·6	5·8	30·67	1·55	Sept. 11	158	8	37	156	0	35	177	55	34	3	2
Norwood	·002	49·3	47·8	48·5	42·5	56·9	17·5	„ 20, 27	85·6	„ 4	46·6	45·8	82	85	7·5	5·6	28·37	1·68	Oct. 9	161	16	39	143	18	47	106	82	11	6	
Croydon......	·003	49·3	47·4	48·4	42·3	56·6	14·9	„ 29	85·1	„ 4	46·5	45·3	81	85	7·8	5·1	30·44	2·18	„ 9	161	17	35	128	0	29	120	60	14	4	7
South Bourne	30·003	49·9	48·5	49·2	43·8	55·8	18·3	„ 28	75·8	Aug. 13	47·5	46·5	83	86	6·4	4·9	30·14	1·02	„ 26	161	3	56	101	34	85	134	80	44	3	5
Ramsgate	....	....	....	....		....	21·0	„ 28	80·0	May 26	....	....	....	....	....	....	31·55	1·95	„ 9	134	3	..	..	..	..	..	..	..	.	2
Hillington	29·969	49·4	45·7	47·6	40·8	56·1	17·9	„ 27	85·1	Sept. 4	47·0	44·6	84	91	7·9	7·2	31·70	1·24	Sept. 11	194	19	19	192	9	26	148	51	86	4	9
Lowestoft ...	29·972	49·4	47·4	48·4	43·1	54·8	16·7	„ 29	78·0	„ 1	47·2	45·8	85	88	7·0	5·7	23·69	1·38	Aug. 7	168	6	49	144	13	41	114	93	45	3	0
																														0
Columns ..	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	2	33

Alston	Cumberland	1145	T. W. Dickinson.
Ashburton	Devon	584	F. Amery.
Aspley Guise, Woburn	Bedford	433	E. E. Dymond, J.P., F.M.S.
Beacon Stoop	Stafford	1216	C. L. Wragge, F.M.S., F.R.G.S.
Belper	Derby	344	J. Hunter, Jun., Assoc. M. Inst. C.E., F.M.S.
Blackburn	Lancashire	513	W. B. Bryan, M.Inst.C.E., F.M.S.
Blackpool	Lancashire	81	C. T. Ward, F.M.S.
Bournemouth	Hants	134	Admiral Sir B. J. Sulivan.
Bridgetown, Totnes	Devon	107	T. H. Edmonds, F.M.S.
Bude	Cornwall	16	J. Arthur.
Burghill, Hereford	Hereford	275	T. A. Chapman, M.D.
Cardiff	Glamorgan	43	W. Adams, M.Inst.C.E., F.M.S.
Chester	Cheshire	65	A. O. Walker, F.L.S., F.M.S.
Cockermouth	Cumberland	144	H. Dodgson, M.D., F.R.A.S., F.M.S.
Colwyn Bay	Denbigh	180	A. O. Walker, F.L.S., F.M.S.
Cranleigh	Surrey	225	J. Bryan.
Cromer	Norfolk	90	J. Cooper, F.R.C.S.
Cullompton	Devon	202	T. Turner, J.P., F.M.S.
Eastbourne	Sussex	24	S. Bretton, F.M.S.
Farley	Stafford	638	C. L. Wragge, F.M.S., F.R.G.S.
Guernsey	Channel Isles	180	F. E. Carey, M.D., F.M.S.
Harestock, Winchester	Hants	304	Lt. Col. H. S. Knight, F.R.A.S., F.M.S.
Hodsock, Worksop	Notts	56	H. Mellish, F.M.S.
Ilfracombe	Devon	25	E. J. Slade-King, M.D.
Isleworth	Middlesex	68	Miss E. A. Ormerod, F.M.S.
Kenilworth	Warwick	290	F. Slade, Assoc. M.Inst.C.E., F.M.S.
Limavady	Londonderry	65	W. B. Fawcett, F.M.S., & T. A. Mercer.
Loughborough	Leicester	169	W. Berridge, F.M.S.
Maker, Devonport	Cornwall	290	Rev. P. H. Newnham, M.A., F.M.S.
Oakamoor	Stafford	350	C. L. Wragge, F.M.S., F.R.G.S.
Portsmouth	Hants	20	R. E. Power, L.R.C.P.
Ross	Hereford	213	H. Southall, F.M.S.
Scarborough (St. Nicholas)	Yorkshire	161	J. McClelland.
Sidmouth	Devon	186	W. T. Radford, M.D., F.R.A.S., F.M.S.
Somerleyton	Suffolk	50	Rev. C. J. Steward, M.A., F.M.S.
Southampton, (Highfield)	Hants	140	Rev. H. Garrett, M.A., F.M.S.
St. Michaels-on-Wyre	Lancashire	26	Rev. P. J. Hornby.
Stapleton	Cumberland	400	T. H. Walker, L.R.C.P., F.M.S.
Swarraton, Alresford	Hants	310	Rev. W. L. W. Eyre, M.A., F.M.S.
Teignmouth (Bitton)	Devon	50	W. C. Lake, M.D., F.M.S.
,, (Woodway)	Devon	285	G. W. Ormerod, M.A., F.G.S., F.M.S.
Throcking, Buntingford	Herts	484	Rev. C. W. Harvey, M.A., F.M.S.
Torquay (Castle College)	Devon	166	C. J. Harland, F.M.S.
,, (Bocombe)	Devon	400	H. Hearder, F.M.S.
Tunbridge	Kent	99	W. C. Punnett, F.M.S.
Tunbridge Wells	Kent	500	F. Green, M.A., F.M.S.
Ventnor	Isle of Wight	80	J. Codling.
Watford	Herts	223	J. Hopkinson, F.L.S., F.G.S., F.M.S.
Weston-super-Mare	Somerset	20	W. E. Perrett.
Worthing	Sussex	21	W. J. Harris, M.R.C.S., F.M.S.

NOTES ON THE TABLES ON PAGES 62, 63 and 64.

The observations at the Climatological Stations are taken *once* daily, viz. at 9 a.m. The Minimum Temperature is entered to the morning on which it is read, while the Maximum Temperature and the Rainfall are entered to the *previous* day.

Abstract of Climatological Observations for the Quarter ending DECEMBER 31st, 1880.

OCTOBER.

Station.	Means at 9 a.m. Temperature.	Means at 9 a.m. Humidity.	Temperature. Means. Min.	Means. Max.	Means. Range.	Means. Mean.	Extremes in Month. Min.	Extremes in Month. Max.	Extremes in Month. Range.	Mean Amount of Cloud at 9 a.m.	Rain. Amount.	Rain. No. of Days.
	°	o/o	°	°	°	°	°	°	°		In.	
Stapleton	43·2	85	35·5	49·5	14·0	42·5	23·0	61·1	38·1	7·1	1·52	10
Alston	39·0	88	31·3	44·9	13·6	38·1	13·8	56·8	43·0	7·7	6·50	20
Cockermouth..	42·4	89	36·1	51·2	15·1	43·7	22·2	61·0	38·8	7·0	1·82	12
Scarborough ..	46·3	86	40·9	51·4	10·5	46·1	31·7	62·4	30·7	7·6	5·71	22
Blackburn ..	43·9	84	35·2	50·7	15·5	42·9	19·5	61·0	41·5	7·1	3·57	16
St. Mich.-on-Wyre	45·0	81	36·8	51·5	14·7	44·1	19·5	63·2	43·7	8·0	2·75	14
Blackpool	45·4	79	38·3	50·7	12·4	44·5	21·5	62·1	40·6	7·2	2·92	13
Colwyn Bay ..	45·8	89	40·1	50·6	10·5	45·4	25·6	65·5	39·9	7·9	6·63	16
Chester	43·9	84	37·6	51·3	13·7	44·4	23·2	66·0	42·8	8·5	4·66	13
Hodsock	44·3	87	38·2	51·6	13·4	44·9	22·6	63·0	40·4	7·0	6·60	16
Belper	43·1	87	38·1	49·5	11·4	43·8	24·7	60·5	35·8	5·5	5·55	13
Beacon Stoop	41·2	88	35·7	46·8	11·1	41·3	23·9	60·2	36·3	7·8	3·96	15
Farley	43·4	84	38·7	49·7	11·0	44·2	25·4	61·6	36·2	7·6	4·38	16
Oakamoor	43·8	83	36·4	50·1	13·7	43·3	21·6	61·5	39·9	8·1	4·22	13
Loughborough	43·5	89	38·4	51·5	13·1	44·9	24·1	64·9	40·8	7·2	5·22	14
Kenilworth ..	43·6	89	37·7	51·0	13·3	44·4	26·1	63·2	37·1	6·8	5·33	15
Burghill	44·0	86	37·5	51·6	14·1	44·5	23·1	64·9	41·8	7·5	4·80	11
Ross	44·3	89	38·3	52·3	14·0	45·3	23·3	66·1	42·8	7·0	5·75	13
Cardiff........	46·2	84	40·8	52·9	12·1	46·9	28·4	63·5	35·1	..	4·94	15
Weston-s-Mare	46·2	87	41·9	53·4	11·5	47·7	30·9	67·9	37·0	7·0	4·31	13
Ilfracombe ..	..	..	46·1	54·9	8·8	50·5	36·5	63·0	26·5	..	..	..
Bude	46·4	88	39·5	55·4	15·9	47·5	26·9	66·2	39·3	6·1	4·64	13
Maker	46·9	86	42·8	54·8	12·0	48·8	31·3	67·0	35·7	6·6	4·74	20
Ashburton	48·6	89	40·5	54·5	14·0	47·0	29·6	65·0	35·4	7·1	9·78	17

NOVEMBER.

Station.	Means at 9 a.m. Temperature.	Means at 9 a.m. Humidity.	Temperature. Means. Min.	Means. Max.	Means. Range.	Means. Mean.	Extremes in Month. Min.	Extremes in Month. Max.	Extremes in Month. Range.	Mean Amount of Cloud at 9 a.m.	Rain. Amount.	Rain. No. of Days.
	°	o/o	°	°	°	°	°	°	°		In.	
Stapleton	39·1	87	32·9	45·1	12·2	39·0	19·0	58·0	39·0	8·5	6·72	18
Alston	36·1	85	28·1	42·6	14·5	35·4	6·9	53·3	46·4	7·1	6·42	20
Cockermouth..	40·1	89	34·5	47·4	12·9	40·9	19·8	56·0	36·2	6·3	5·98	19
Scarborough ..	42·4	89	36·2	47·8	11·6	42·0	22·4	58·4	36·0	7·1	2·37	21
Blackburn ..	40·3	90	32·6	46·3	13·7	39·5	18·0	55·2	37·2	6·2	5·86	23
St. Mich.-on-Wyre	40·6	89	33·8	47·5	13·7	40·7	18·0	56·1	38·1	5·9	4·60	19
Blackpool	40·8	86	35·0	46·7	11·7	40·9	19·2	53·6	34·4	4·6	4·66	19
Colwyn Bay ..	43·6	90	38·8	49·3	10·5	44·0	26·3	60·9	34·6	6·8	4·80	19
Chester	41·2	84	35·5	48·8	13·3	42·2	18·6	59·3	40·7	7·6	2·64	16
Hodsock	40·8	88	34·6	48·6	14·0	41·6	19·8	62·7	42·9	5·7	2·36	14
Belper	40·5	86	35·3	47·2	11·9	41·3	22·5	58·2	35·7	5·3	3·14	14
Beacon Stoop	38·6	91	31·9	44·4	12·5	38·1	21·2	53·7	32·5	6·9	2·63	16
Farley	40·7	85	35·7	46·7	11·0	41·2	20·7	57·3	36·6	6·7	3·39	19
Oakamoor	40·7	85	32·9	47·7	14·8	40·3	17·9	60·6	42·7	6·5	3·70	16
Loughborough	40·2	87	34·9	48·9	14·0	41·9	20·0	59·0	39·0	6·3	1·92	14
Kenilworth ..	40·4	91	34·3	47·8	13·5	41·0	17·4	58·0	40·6	6·3	2·18	14
Burghill	41·3	85	35·2	48·7	13·5	42·0	21·9	60·7	38·8	6·6	1·79	15
Ross	41·8	86	36·0	48·8	12·8	42·4	23·3	59·9	36·6	6·0	2·97	14
Cardiff........	43·1	85	38·2	49·2	11·0	43·7	25·7	57·9	32·2	..	3·67	14
Weston-s-Mare	43·0	87	37·9	49·4	11·5	43·6	22·9	58·5	35·6	6·6	1·71	15
Ilfracombe ..	..	..	43·0	51·1	8·1	47·0	28·0	57·5	29·5	..	..	..
Bude	44·3	90	39·1	50·2	11·1	44·6	24·8	56·4	31·6	6·1	2·90	15
Maker	45·3	86	41·5	50·3	8·8	45·9	30·2	55·6	25·4	6·6	3·30	16
Ashburton	45·4	89	38·8	50·8	12·0	44·8	25·1	58·0	32·9	6·5	7·08	17

DECEMBER.

Station.	Means at 9 a.m. Temperature.	Means at 9 a.m. Humidity.	Temperature. Means. Min.	Means. Max.	Means. Range.	Means. Mean.	Extremes in Month. Min.	Extremes in Month. Max.	Extremes in Month. Range.
	°	o/o	°	°	°	°	°	°	°
Stapleton	36·4	91	32·6	41·7	9·1	37·2	16·0	54·5	38[illegible]
Alston	34·0	87	28·8	39·9	11·1	34·3	5·9	49·8	43[illegible]
Cockermouth..	39·3	90	35·7	44·1	8·4	39·9	19·4	51·4	32[illegible]
Scarborough ..	38·6	90	35·1	44·4	9·3	39·8	27·7	53·9	26[illegible]
Blackburn ..	38·9	94	33·6	43·3	9·7	38·4	22·0	52·5	30[illegible]
St. Mich.-on-Wyre	39·1	91	35·2	45·3	10·1	40·2	19·3	51·7	32[illegible]
Blackpool	40·9	88	36·9	45·4	8·5	41·1	24·5	50·2	25[illegible]
Colwyn Bay ..	42·4	87	39·0	47·8	8·8	43·4	28·7	56·0	27[illegible]
Chester	41·1	87	36·8	47·0	10·2	41·9	26·5	55·8	29[illegible]
Hodsock	39·2	90	34·6	46·5	11·9	40·6	24·0	58·8	34[illegible]
Belper	39·4	91	35·0	44·9	9·9	39·9	26·2	53·3	27[illegible]
Beacon Stoop	37·5	95	32·9	42·4	9·5	37·7	25·2	51·3	26[illegible]
Farley	38·4	93	34·6	44·2	9·6	39·4	24·1	53·6	29[illegible]
Oakamoor	38·8	94	33·3	45·2	11·9	39·2	20·3	54·7	34[illegible]
Loughborough	40·7	91	36·9	46·6	9·7	41·8	26·5	56·6	30[illegible]
Kenilworth ..	40·3	92	35·3	46·2	10·9	40·8	23·0	54·0	31[illegible]
Burghill	41·8	88	36·7	48·1	11·4	42·4	27·1	55·7	28[illegible]
Ross	42·1	89	37·4	48·3	10·9	42·9	28·3	56·0	27[illegible]
Cardiff........	43·8	91	39·7	48·6	8·9	44·1	27·9	53·9	26[illegible]
Weston-s-Mare	44·3	90	40·6	48·4	7·8	44·5	31·9	53·6	21[illegible]
Ilfracombe ..	..	..	44·6	51·6	7·0	48·1	35·0	56·0	21[illegible]
Bude	46·9	92	42·2	50·6	8·4	46·4	31·8	54·5	2[illegible]
Maker	46·3	88	43·5	50·2	6·7	46·9	33·5	55·0	21[illegible]
Ashburton	45·0	92	40·4	50·8	10·4	45·6	29·0	54·9	2[illegible]

Calm.

Abstract of Climatological Observations for the Quarter ending DECEMBER 31st, 1880.

OCTOBER. Temperature. Means. ange.	OCTOBER. Temperature. Means. Mean.	OCTOBER. Extremes in Month. Min.	OCTOBER. Extremes in Month. Max.	OCTOBER. Extremes in Month. Range.	OCTOBER. Mean Amount of Cloud at 9 a.m.	OCTOBER. Rain. Amount.	OCTOBER. Rain. No. of Days.	NOVEMBER. Means at 9 a.m. Temperature.	NOVEMBER. Means at 9 a.m. Humidity.	NOVEMBER. Temperature. Means. Min.	NOVEMBER. Means. Max.	NOVEMBER. Means. Range.	NOVEMBER. Means. Mean.	NOVEMBER. Extremes in Month. Min.	NOVEMBER. Extremes in Month. Max.	NOVEMBER. Extremes in Month. Range.	NOVEMBER. Mean Amount of Cloud at 9 a.m.	NOVEMBER. Rain. Amount.	NOVEMBER. Rain. No. of Days.	DECEMBER. Means at 9 a.m. Temperature.	DECEMBER. Means at 9 a.m. Humidity.	DECEMBER. Temperature. Means. Min.	DECEMBER. Means. Max.	DECEMBER. Means. Range.	DECEMBER. Means. Mean.	DECEMBER. Extremes in Month. Min.	DECEMBER. Extremes in Month. Max.	DECEMBER. Extremes in Month. Range.	DECEMBER. Mean Amount of Cloud at 9 a.m.	DECEMBER. Rain. Amount.	DECEMBER. Rain. No. of Days.
°	°	°	°	°		In.		°	o/o	°	°	°	°	°	°	°		In.		°	o/o	°	°	°	°	°	°	°		In.	
7·0	47·7	23·8	68·1	44·3	6·8	9·89	18	44·5	87	36·4	52·2	15·8	44·3	22·5	59·2	36·7	6·0	5·82	17	45·3	90	39·6	52·0	12·4	45·8	25·4	57·2	31·8	7·5	6·55	19
1·9	48·6	29·9	65·4	35·5	7·0	7·68	19	46·1	88	40·7	50·3	9·6	45·5	28·1	57·1	29·0	6·7	3·82	15	46·5	91	42·4	50·9	8·5	46·6	31·0	55·2	24·2	7·5	4·71	16
2·5	48·1	30·9	65·5	34·6	7·8	8·19	17	44·8	88	39·9	49·7	9·8	44·8	28·8	56·2	27·4	7·3	3·33	15	45·6	87	41·2	50·1	8·9	45·7	30·5	54·7	24·2	7·5	4·21	18
3·6	49·3	30·3	64·1	33·8	7·5	7·41	15	45·5	85	40·3	52·3	12·0	46·3	28·7	59·3	30·6	7·0	3·23	14	45·9	88	42·0	51·8	9·8	46·9	31·3	56·6	25·3	8·0	4·05	19
6·4	48·6	30·3	67·0	36·7	6·5	7·56	16	46·1	90	38·1	52·3	14·2	45·2	25·0	59·2	34·2	6·6	3·36	14	46·6	94	40·1	52·1	12·0	46·1	29·3	57·5	28·2	7·2	4·17	19
2·5	47·9	30·5	64·3	33·8	7·5	5·28	14	44·4	87	39·5	49·9	10·4	44·7	24·8	57·0	32·2	6·9	2·51	17	45·6	89	41·2	53·4	12·2	47·3	28·8	54·4	25·6	8·0	4·08	20
6·0	45·9	23·7	64·7	41·0	7·0	5·11	19	42·5	88	35·7	49·5	13·8	42·6	16·4	58·1	41·7	7·3	3·70	16	43·8	91	38·7	49·2	10·5	43·9	26·3	54·8	28·5	7·8	4·72	20
4·3	47·7	29·5	65·3	35·8	6·1	6·45	18	43·2	92	38·1	49·8	11·7	43·9	22·8	57·9	35·1	5·5	3·38	13	44·4	94	39·8	49·5	9·7	44·7	29·2	56·1	26·9	6·3	5·14	17
0·9	50·2	32·8	66·5	33·7	7·0	8·28	18	45·9	85	41·5	50·7	9·2	46·1	28·5	57·1	28·6	6·5	5·00	12	46·1	90	42·3	51·2	8·9	46·7	31·7	54·8	23·1	7·6	5·16	20
5·8	47·4	25·6	67·7	42·1	6·0	6·40	20	44·2	87	33·2	49·9	16·7	41·6	21·7	57·1	35·4	6·2	2·70	15	45·2	91	35·1	49·4	14·3	42·2	24·0	54·5	30·5	6·5	3·96	19
2·5	49·0	32·0	66·6	34·6	6·4	6·60	18	44·4	88	38·9	49·0	10·1	43·9	29·3	55·5	26·2	6·0	3·62	13	44·7	93	39·7	48·6	8·9	44·2	29·3	54·9	25·6	7·2	4·22	17
1·3	49·2	32·5	65·7	33·2	7·9	8·23	16	44·9	86	38·8	49·5	10·7	44·2	28·0	56·6	28·6	6·7	4·13	9	45·7	90	41·2	49·9	8·7	45·5	32·4	54·8	22·4	7·8	5·44	13
5·0	47·3	27·0	67·1	40·1	6·6	4·37	20	43·5	87	36·4	49·2	12·8	42·8	22·1	55·9	33·8	5·7	2·81	17	43·7	92	37·9	48·9	11·0	43·4	23·5	54·3	30·8	7·1	4·21	21
3·8	46·6	27·3	65·3	38·0	7·2	3·94	15	41·8	83	35·5	48·6	13·1	42·1	20·1	57·2	37·1	7·5	3·12	12	43·2	84	38·0	47·9	9·9	42·9	27·2	53·9	26·7	7·7	3·53	14
4·0	45·7	23·3	65·4	42·1	7·2	4·73	17	41·1	91	34·7	47·8	13·1	41·3	18·8	59·0	40·2	2·9	3·00	12	42·6	93	37·5	47·4	9·9	42·4	24·1	52·9	28·8	8·1	3·32	14
·7	46·8	26·7	67·0	40·3	7·3	6·37	20	43·2	91	34·3	49·2	14·9	41·8	23·2	56·7	33·5	5·6	3·47	12	44·0	91	36·2	48·9	12·7	42·5	25·1	55·9	30·8	6·9	3·52	16
·7	46·5	28·3	65·1	36·8	8·2	7·35	19	41·7	88	36·6	46·9	10·3	41·8	25·7	54·0	28·3	7·5	4·27	15	42·4	93	37·8	46·7	8·9	42·2	28·8	54·0	25·2	8·3	3·24	16
·7	47·2	28·3	66·0	37·7	7·5	7·16	19	42·3	87	36·0	48·5	12·5	42·2	25·5	56·3	30·8	6·0	3·40	13	42·7	92	38·2	48·0	9·8	43·1	27·1	56·3	29·2	7·4	2·93	16
·7	47·0	26·8	65·9	39·1	7·9	5·97	19	41·8	89	35·0	49·2	14·2	42·1	22·3	57·8	35·5	6·6	1·90	14	42·3	92	37·0	47·8	10·8	42·4	25·4	55·5	30·1	8·1	3·26	18
·2	45·9	26·0	62·9	36·9	6·8	5·83	20	41·1	88	34·5	47·8	13·3	41·1	19·9	56·5	36·6	5·6	2·55	14	41·2	90	36·3	46·4	10·1	41·4	26·0	55·3	29·3	7·5	3·69	17
·7	45·6	27·5	63·6	36·1	6·9	4·73	16	41·4	91	35·4	47·8	12·4	41·6	20·7	55·8	35·1	6·2	1·88	13	40·8	95	36·3	46·5	10·2	41·4	27·9	55·1	27·2	7·5	2·00	15
·8	45·4	28·3	61·3	33·0	7·0	4·81	17	39·6	93	34·5	46·5	12·0	40·5	21·6	55·4	33·8	5·9	2·30	13	39·4	94	35·3	44·9	9·6	40·1	27·2	53·9	26·7	7·7	2·66	21
·0	48·1	32·1	63·8	31·7	7·5	3·79	21	42·6	87	36·2	48·6	12·4	42·4	24·8	58·8	34·0	6·3	2·27	23	40·7	90	36·3	46·4	10·1	41·3	26·8	54·9	28·1	6·2	2·26	22
	..	..	..	..	8·0	5·80	15	42·7	89	37·6	..	..	..	25·1	58·0	32·9	6·6	2·28	13	40·3	95	35·8	46·0	10·2	40·9	28·1	54·0	25·9	5·8	2·39	13
·3	52·1	32·8	71·1	38·3	6·7	9·82	20	48·0	87	43·2	53·0	9·8	48·1	33·0	59·5	26·5	8·1	4·58	22	49·2	92	45·4	53·2	7·8	49·3	37·0	55·7	18·7	8·4	4·95	21
·6	44·8	26·0	59·8	33·8	6·0	1·92	20	41·3	88	36·0	47·4	11·4	41·7	17·4	55·6	38·2	6·0	4·96	23	40·0	89	34·8	45·6	10·8	40·2	20·5	56·2	15·7	7·2	3·62	22

The atmospheric pressure in January was greater than in December by 0·065 in., that February was less than in January by 0·570 in., and that in March was greater than in Febru...
From the preceding 39 years' observations the *mean pressure* in January is

Abstract of Climatological Observations for the Quarter ending DECEMBER 31st, 1880.

OCTOBER.

Station.	Means at 9 a.m. Temperature.	Means at 9 a.m. Humidity.	Temperature. Means. Min.	Means. Max.	Means. Range.	Means. Mean.	Extremes in Month. Min.	Extremes in Month. Max.	Extremes in Month. Range.	Mean Amount of Cloud at 9 a.m.	Rain. Amount.	Rain. No. of Days.
	°	o/o	°	°	°	°	°	°	°		In.	
Stapleton	43·2	85	35·5	49·5	14·0	42·5	23·0	61·1	38·1	7·1	1·52	10
Alston	39·0	88	31·3	44·9	13·6	38·1	13·8	56·8	43·0	7·7	6·50	20
Cockermouth..	42·4	89	36·1	51·2	15·1	43·7	22·2	61·0	38·8	7·0	1·82	12
Scarborough ..	46·3	86	40·9	51·4	10·5	46·1	31·7	62·4	30·7	7·6	5·71	22
Blackburn ..	43·9	84	35·2	50·7	15·5	42·9	19·5	61·0	41·5	7·1	3·57	16
St. Mich.-on-Wyre	45·0	81	36·8	51·5	14·7	44·1	19·5	63·2	43·7	8·0	2·75	14
Blackpool	45·4	79	38·3	50·7	12·4	44·5	21·5	62·1	40·6	7·2	2·92	13
Colwyn Bay ..	45·8	89	40·1	50·6	10·5	45·4	25·6	65·5	39·9	7·9	6·63	16
Chester	43·9	84	37·6	51·3	13·7	44·4	23·2	66·0	42·8	8·5	4·66	13
Hodsock	44·3	87	38·2	51·6	13·4	44·9	22·6	63·0	40·4	7·0	6·60	16
Belper	43·1	87	38·1	49·5	11·4	43·8	24·7	60·5	35·8	5·5	5·55	13
Beacon Stoop	41·2	88	35·7	46·8	11·1	41·3	23·9	60·2	36·3	7·8	3·96	15
Farley	43·4	84	38·7	49·7	11·0	44·2	25·4	61·6	36·2	7·6	4·38	16
Oakamoor	43·8	83	36·4	50·1	13·7	43·3	21·6	61·5	39·9	8·1	4·22	13
Loughborough	43·5	89	38·4	51·5	13·1	44·9	24·1	64·9	40·8	7·2	5·22	14
Kenilworth ..	43·6	89	37·7	51·0	13·3	44·4	26·1	63·2	37·1	6·8	5·33	15
Burghill	44·0	86	37·5	51·6	14·1	44·5	23·1	64·9	41·8	7·5	4·80	11
Ross	44·3	89	38·3	52·3	14·0	45·3	23·3	66·1	42·8	7·0	5·75	13
Cardiff........	46·2	84	40·8	52·9	12·1	46·9	28·4	63·5	35·1	..	4·94	15
Weston-s-Mare	46·2	87	41·9	53·4	11·5	47·7	30·9	67·9	37·0	7·0	4·31	13
Ilfracombe ..	..	..	46·1	54·9	8·8	50·5	36·5	63·0	26·5	..	..	..
Bude	46·4	88	39·5	55·4	15·9	47·5	26·9	66·2	39·3	6·1	4·64	13
Maker	46·9	86	42·8	54·8	12·0	48·8	31·3	67·0	35·7	6·6	4·74	20
Ashburton	48·6	89	40·5	54·5	14·0	47·0	29·6	65·0	35·4	7·1	9·78	17

NOVEMBER.

Station.	Means at 9 a.m. Temperature.	Means at 9 a.m. Humidity.	Temperature. Means. Min.	Means. Max.	Means. Range.	Means. Mean.	Extremes in Month. Min.	Extremes in Month. Max.	Extremes in Month. Range.	Mean Amount of Cloud at 9 a.m.	Rain. Amount.	Rain. No. of Days.
	°	o/o	°	°	°	°	°	°	°		In.	
Stapleton	39·1	87	32·9	45·1	12·2	39·0	19·0	58·0	39·0	8·5	6·72	18
Alston	36·1	85	28·1	42·6	14·5	35·4	6·9	53·3	46·4	7·1	6·42	20
Cockermouth..	40·1	89	34·5	47·4	12·9	40·9	19·8	56·0	36·2	6·3	5·98	19
Scarborough ..	42·4	89	36·2	47·8	11·6	42·0	22·4	58·4	36·0	7·1	2·37	21
Blackburn ..	40·3	90	32·6	46·3	13·7	39·5	18·0	55·2	37·2	6·2	5·86	23
St. Mich.-on-Wyre	40·6	89	33·8	47·5	13·7	40·7	18·0	56·1	38·1	5·9	4·60	19
Blackpool	40·8	86	35·0	46·7	11·7	40·9	19·2	53·6	34·4	4·6	4·66	19
Colwyn Bay ..	43·6	90	38·8	49·3	10·5	44·0	26·3	60·9	34·6	6·8	4·80	19
Chester	41·2	84	35·5	48·8	13·3	42·2	18·6	59·3	40·7	7·6	2·64	16
Hodsock	40·8	88	34·6	48·6	14·0	41·6	19·8	62·7	42·9	5·7	2·36	14
Belper	40·5	86	35·3	47·2	11·9	41·3	22·5	58·2	35·7	5·3	3·14	14
Beacon Stoop	38·6	91	31·9	44·4	12·5	38·1	21·2	53·7	32·5	6·9	2·63	16
Farley	40·7	85	35·7	46·7	11·0	41·2	20·7	57·3	36·6	6·7	3·39	19
Oakamoor	40·7	85	32·9	47·7	14·8	40·3	17·9	60·6	42·7	6·5	3·70	16
Loughborough	40·2	87	34·9	48·9	14·0	41·9	20·0	59·0	39·0	6·3	1·92	14
Kenilworth ..	40·4	91	34·3	47·8	13·5	41·0	17·4	58·0	40·6	6·3	2·18	14
Burghill	41·3	85	35·2	48·7	13·5	42·0	21·9	60·7	38·8	6·6	1·79	15
Ross	41·8	86	36·0	48·8	12·8	42·4	23·3	59·9	36·6	6·0	2·97	14
Cardiff........	43·1	85	38·2	49·2	11·0	43·7	25·7	57·9	32·2	..	3·67	14
Weston-s-Mare	43·0	87	37·9	49·4	11·5	43·6	22·9	58·5	35·6	6·6	1·71	15
Ilfracombe ..	..	..	43·0	51·1	8·1	47·0	28·0	57·5	29·5	..	..	..
Bude	44·3	90	39·1	50·2	11·1	44·6	24·8	56·4	31·6	6·1	2·90	15
Maker	45·3	86	41·5	50·3	8·8	45·9	30·2	55·6	25·4	6·6	3·30	16
Ashburton	45·4	89	38·8	50·8	12·0	44·8	25·1	58·0	32·9	6·5	7·08	17

DECEMBER.

Station.	Means at 9 a.m. Temperature.	Means at 9 a.m. Humidity.	Temperature. Means. Min.	Means. Max.	Means. Range.	Means. Mean.	Extremes in Month. Min.	Extremes in Month. Max.	Extremes in Month. Range.
	°	o/o	°	°	°	°	°	°	°
Stapleton	36·4	91	32·6	41·7	9·1	37·2	16·0	54·5	38[illegible]
Alston	34·0	87	28·8	39·9	11·1	34·3	5·9	49·8	43[illegible]
Cockermouth..	39·3	90	35·7	44·1	8·4	39·9	19·4	51·4	32[illegible]
Scarborough ..	38·6	90	35·1	44·4	9·3	39·8	27·7	53·9	26[illegible]
Blackburn ..	38·9	94	33·6	43·3	9·7	38·4	22·0	52·5	30[illegible]
St. Mich.-on-Wyre	39·1	91	35·2	45·3	10·1	40·2	19·3	51·7	32[illegible]
Blackpool	40·9	88	36·9	45·4	8·5	41·1	24·5	50·2	25[illegible]
Colwyn Bay ..	42·4	87	39·0	47·8	8·8	43·4	28·7	56·0	27[illegible]
Chester	41·1	87	36·8	47·0	10·2	41·9	26·5	55·8	29[illegible]
Hodsock	39·2	90	34·6	46·5	11·9	40·6	24·0	58·8	34[illegible]
Belper	39·4	91	35·0	44·9	9·9	39·9	26·2	53·3	27[illegible]
Beacon Stoop	37·5	95	32·9	42·4	9·5	37·7	25·2	51·3	26[illegible]
Farley	38·4	93	34·6	44·2	9·6	39·4	24·1	53·6	29[illegible]
Oakamoor	38·8	94	33·3	45·2	11·9	39·2	20·3	54·7	34[illegible]
Loughborough	40·7	91	36·9	46·6	9·7	41·8	26·5	56·6	30[illegible]
Kenilworth ..	40·3	92	35·3	46·2	10·9	40·8	23·0	54·0	31[illegible]
Burghill	41·8	88	36·7	48·1	11·4	42·4	27·1	55·7	28[illegible]
Ross	42·1	89	37·4	48·3	10·9	42·9	28·3	56·0	27[illegible]
Cardiff........	43·8	91	39·7	48·6	8·9	44·1	27·9	53·9	26[illegible]
Weston-s-Mare	44·3	90	40·6	48·4	7·8	44·5	31·9	53·6	21[illegible]
Ilfracombe ..	..	..	44·6	51·6	7·0	48·1	35·0	56·0	21[illegible]
Bude	46·9	92	42·2	50·6	8·4	46·4	31·8	54·5	2[illegible]
Maker	46·3	88	43·5	50·2	6·7	46·9	33·5	55·0	21[illegible]
Ashburton	45·0	92	40·4	50·8	10·4	45·6	29·0	54·9	2[illegible]

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING MARCH 31, 1880.

REMARKS ON THE WEATHER DURING THE QUARTER ENDING MARCH 31ST, 1880.

By JAMES GLAISHER, ESQ., F.R.S., *&c.*

January was an exceedingly cold month, with the smallest rainfall since 1826, very high barometer readings throughout the month, and an absence of strong winds. Several days towards the end of the month were distinguished by very low temperatures; the table on page 66, shows the minimum readings on those days at the several stations.

February was a warm month, with a rainfall somewhat above its average, with high barometer readings during the first week, and low afterwards, and with strong winds occasionally.

March was warm during the first half of the month, with frequent strong winds; from the 11th day the wind was mostly from the east, and occasionally the weather was cold; the rainfall was small, and the readings of the barometer were high and constantly above their averages from the 5th day. The month was most favourable for agricultural work.

The few days of warm weather with which the year 1879 closed continued till the 5th day of January, the average excess of these five days was 6½°. On the 6th a cold period set in and continued to February 5th, the average deficiency of temperature for these 31 days was 5½°, and from February 6th to March 31st the weather was with few exceptions warm, and the mean daily excess for these 55 days was 3°·2.

With January closed the very long period of 15 months in succession of the mean temperature of each month being below its average. The mean temperature of the 15 months ending January in every year from 1773 to 1880 is shown in the following table :—

TABLE showing the MEAN TEMPERATURE of the Fifteen Months ending JANUARY, from 1771—1773 to 1878—1880.

YEARS.	Mean Temp. of the 15 months ending Jan.	YEARS.	Mean Temp. of the 15 months ending Jan.	YEARS.	Mean Temp. of the 15 months ending Jan.	YEARS.	Mean Temp. of the 15 months ending Jan.	YEARS.	Mean Temp. of the 15 months ending Jan.	YEARS.	Mean Temp. of the 15 months ending Jan.
	°		°		°		°		°		°
1771—1773	45·6	1789—1791	46·5	1807—1809	45·9	1825—1827	47·6	1843—1845	47·3	1861—1863	47·9
1772—1774	44·9	1790—1792	46·2	1808—1810	46·4	1826—1828	46·9	1844—1846	46·1	1862—1864	48·3
1773—1775	46·1	1791—1793	45·8	1809—1811	46·5	1827—1829	47·9	1845—1847	49·2	1863—1865	47·4
1774—1776	46·9	1792—1794	46·1	1810—1812	47·5	1828—1830	45·2	1846—1848	47·3	1864—1866	48·7
1775—1777	46·2	1793—1795	46·3	1811—1813	45·0	1829—1831	45·5	1847—1849	48·8	1865—1867	48·6
1776—1778	46·4	1794—1796	46·1	1812—1814	44·6	1830—1832	48·1	1848—1850	48·0	1866—1868	47·2
1777—1779	47·0	1795—1797	46·3	1813—1815	43·9	1831—1833	47·3	1849—1851	47·9	1867—1869	49·2
1778—1780	48·7	1796—1798	45·0	1814—1816	47·1	1832—1834	47·9	1850—1852	48·0	1868—1870	48·0
1779—1781	47·0	1797—1799	46·6	1815—1817	44·8	1833—1835	49·2	1851—1853	48·5	1869—1871	46·6
1780—1782	47·3	1798—1800	44·6	1816—1818	45·9	1834—1836	47·5	1852—1854	47·2	1870—1872	46·7
1781—1783	44·4	1799—1801	46·3	1817—1819	48·0	1835—1837	48·1	1853—1855	46·6	1871—1873	48·4
1782—1784	45·1	1800—1802	46·8	1818—1820	47·4	1836—1838	45·2	1854—1856	45·6	1872—1874	47·8
1783—1785	43·6	1801—1803	45·7	1819—1821	45·6	1837—1839	45·7	1855—1857	46·7	1873—1875	48·0
1784—1786	44·3	1802—1804	46·6	1820—1822	47·5	1838—1840	46·1	1856—1858	48·8	1874—1876	46·8
1785—1787	44·1	1803—1805	47·5	1821—1823	49·0	1839—1841	46·1	1857—1859	48·1	1875—1877	48·1
1786—1788	45·8	1804—1806	46·1	1822—1824	45·9	1840—1842	46·2	1858—1860	48·6	1876—1878	48·3
1787—1789	45·8	1805—1807	48·1	1823—1825	48·7	1841—1843	47·0	1859—1861	45·1	1877—1879	47·6
1788—1790	44·6	1806—1808	47·4	1824—1826	47·7	1842—1844	48·0	1860—1862	47·3	1878—1880	44·0
Mean -	45·8	Mean -	46·4	Mean -	46·5	Mean -	46·9	Mean -	47·5	Mean -	47·7

From this table it will be seen that the mean temperature of the 15 months ending January 1880 was 44°·0, and we have to go back to the years 1813-15 for a similar cold period, and still further back to the years 1783-85, for one of somewhat lower temperature, but in the year 1814 both May and December were more than 2° above their averages, and in 1784 the month of May was 4° above its average, September was 1° above; and January 1785 was nearly ½° in excess of its average. Therefore there is no instance as far back as we can go of 15 months in succession, every one being below its average.

The readings of the barometer in the neighbourhood of London were above their averages from the 1st of January till the 4th of February without exception; on many days together during this period the mean daily readings were between 0·6 in. and 0·7 in. in excess of the average, the mean amount of excess for the 36 days ending February 5th was 0·44 in. From the 6th of February till the 4th March the readings were below their averages, except on four days, viz. :— February 13th, 23rd, 24th, and 25th, on which days they were slightly above their averages, the mean amount of defect for the 28 days ending March 4th was 0·31 in. From the 5th to the 30th of March the readings were all above their average values, and the mean amount of excess for the 26 days was 0·20 in. The mean reading on the last day of the quarter was 0·47 in. below the average.

The mean reading for the month of January was 30·204 ins., being 0·448 in. above the average, and higher than any value back to 1841; the nearest approach was 30·177 ins. in the year 1858.

The mean reading for the month of February was 29·634 ins., being 0·156 in. below the average.

The mean reading for the month of March was 29·937 ins., being 0·195 in. above the average.

The atmospheric pressure in January was greater than in December by 0·065 in., that in February was less than in January by 0·570 in., and that in March was greater than in February by 0·303 in. From the preceding 39 years' observations the *mean pressure* in January is less

than in December by 0·030 in., that in February is greater than in January by 0·034 in., and that in March is less than in February by 0·048 in.

The mean increase of *pressure* from December to January from all stations was 0·068 in. The mean decrease from January to February from all places was 0·592 in., and the mean increase from February to March from all stations was 0·325 in.

At *Greenwich* the *mean temperature* of January was higher than that in December by 0°·8, that in February was higher than that in January by 8°·6, and that in March was higher than that in February by 2°·5. From the preceding 39 years' observations the *mean temperature* of January is lower than that of December by 1°·4, that of February is higher than that of January by 0°·8, and that of March is higher than that of February by 2°·2. The increase of *mean temperature* from December to January from all places was 1°·2; the increase from January to February was 7°·2, and the further increase from February to March was 1°·5.

The mean temperature of the air for January was 33°·2, being 3°·3 and 5°·4, respectively, below the averages of the preceding 109 years, and 39 years. It was 1°·3 higher than the value in 1879, but with this exception it was lower than any value back to 1871.

The mean temperature of the air for February was 41°·8, being 3°·1 and 2°·4, respectively, above the averages of the preceding 109 years, and 39 years. It was 3°·6 higher than the value in 1879.

The mean temperature of the air for March was 44°·3, being 3°·2 and 2°·7, respectively, above the averages of the 109 years, and 39 years. It was 3°·1 higher than the value in 1879, and higher than any value since 1872.

The mean temperature of the air for the quarter was 39°·8, being 1°·0 above the average of the preceding 109 years, and 0°·1, below the average of the preceding 39 years.

The mean high day temperatures of the air were 2°·6, and 3°·3, respectively, above their averages in February and March, but 5°·7, below in January.

TABLE showing the MINIMUM TEMPERATURES of the AIR at the several STATIONS on the 19th, 20th, 21st, 25th, 26th, 27th, 28th, and 29th of January 1880.

Names of Stations.	JANUARY, 1880.							
	19th.	20th.	21st.	25th.	26th.	27th.	28th.	29th.
	°	°	°	°	°	°	°	°
Guernsey	34·5	27·0	27·0	30·5	30·0	27·0	30·0	31·5
Helston	35·0	34·0	35·0	35·0	30·0	28·0	28·0	33·0
Truro	32·0	31·0	31·0	34·0	28·0	27·0	25·0	28·0
Plymouth	31·8	29·5	30·5	32·5	25·5	24·8	23·2	25·0
Torquay	30·3	30·1	28·7	35·0	25·3	22·1	21·0	35·0
Ventnor	31·5	25·0	25·1	32·8	26·3	30·0	25·7	24·0
Osborne	25·8	20·3	18·2	20·3	23·7	22·8	19·3	22·6
Bournemouth	24·1	21·1	19·1	29·2	24·1	21·1	18·3	26·0
Brighton	21·6	20·4	22·3	26·8	22·5	25·0	20·8	19·3
Salisbury	19·5	13·0	12·0	20·0	14·5	13·0	9·5	16·5
Barnstaple	28·0	23·0	20·0	33·0	20·0	23·0	20·0	28·0
Caterham	22·0	16·4	19·5	27·0	17·1	16·2	13·2	15·2
Ramsgate	21·0	23·2	21·5	27·0	27·1	23·5	21·0	22·1
Strathfield Turgiss	20·5	14·0	15·5	23·9	13·3	14·7	16·9	18·9
Bath	20·9	15·9	20·5	27·3	20·1	20·2	14·5	23·4
Marlborough	21·2	14·7	15·4	25·2	18·5	16·3	8·6	23·1
Bristol	24·3	17·5	19·0	30·0	22·0	20·1	19·0	19·2
Blackheath	21·0	17·2	18·0	23·3	17·5	17·9	18·4	15·0
Greenwich	21·4	17·6	19·3	22·8	17·8	17·2	20·2	17·7
Streatley	23·7	15·0	15·2	29·5	16·9	15·8	17·3	18·0
Camden Square	26·3	19·6	20·2	29·6	20·1	19·2	21·2	22·8
Oxford	16·5	15·5	17·8	20·5	15·5	18·0	18·2	22·2
Royston	21·3	17·3	20·4	26·4	19·7	18·2	15·1	18·1
Cardington	22·0	17·6	18·0	28·4	23·0	18·4	18·6	13·0
Cambridge	19·5	18·5	22·0	28·0	19·5	16·0	17·6	21·0
Rugby	23·5	12·0	20·0	27·0	21·5	15·0	17·0	17·0
Lowestoft	24·0	23·2	28·7	20·1	26·8	24·0	21·0	16·7
Somerleyton	24·2	23·2	28·6	29·0	20·7	21·2	17·2	13·7
Wolverhampton	22·2	16·2	20·0	27·2	25·3	15·6	19·8	18·7
Norwich	21·0	26·0	29·5	30·0	28·5	24·0	19·0	22·0
Leicester	24·5	18·6	22·0	27·8	26·5	20·0	21·0	17·0
Nottingham	25·6	15·5	18·0	28·0	27·9	17·5	22·6	14·0
Llandudno	27·7	26·8	24·2	30·0	27·3	25·3	32·0	38·0
Sheffield	23·0	21·0	26·0	28·0	28·0	21·7	23·2	25·5
Kelstern Grange	27·7	25·0	27·1	25·9	23·1	22·1	18·1	17·0
Liverpool	28·0	22·8	23·6	30·0	27·3	19·7	22·5	21·9
Bolton	20·5	10·7	15·2	25·0	19·8	12·1	14·0	15·0
Bermerside	22·0	10·0	25·0	27·0	21·0	22·0	25·0	26·3
Hull	24·0	23·0	30·0	27·0	25·0	21·0	24·0	21·0
Stonyhurst	17·0	19·4	21·8	26·5	18·5	23·0	25·5	30·9
Bradford	27·1	20·8	22·8	28·0	27·1	23·7	28·0	28·1
Leeds	26·0	21·0	28·0	28·0	24·0	21·0	19·0	22·0
Cockermouth	23·9	17·1	18·2	29·1	23·8	30·6	37·0	40·2
Silloth	24·1	18·5	19·0	25·8	24·8	25·2	36·2	37·4
Carlisle	18·6	15·3	16·5	22·0	27·2	23·3	30·2	32·8
Sunderland	20·0	30·0	32·0	30·0	27·0	26·0	30·0	31·0
North Shields	26·2	22·2	30·0	27·6	25·4	23·8	28·0	27·5
Waringstown (Ireland)	25·0	16·0	16·0	31·0	32·0	33·0	41·0	44·0

From this table it will be seen that on January 19th the lowest reading was 16°·5 at Oxford; on the 20th was 10°·7 at Bolton; on the 21st was 12°·0 at Salisbury; on the 25th was 20°·5 at Oxford; on the 26th was 14°·5 at Salisbury; on the 27th was 12°·1 at Bolton and 13°·0 at Salisbury; on the 28th was 8°·6 at Marlborough and 9°·5 at Salisbury, and on the 29th was 13°0 at Cardington and 13°·7 at Somerleyton.

The mean low night temperatures of the air were 2°·3, and 1°·7, respectively, above their averages in February and March, but 5°·6, below in January. Therefore the days and nights were very cold in January, but somewhat warm both in February and March.

The mean daily ranges of temperature were 0°·2 and 1°·6, respectively, above their averages in February and March, but the same as the average in January.

1880. Months.	Temperature of Air. Mean.	Air. Diff. from average of 109 years.	Air. Diff. from average of 39 years.	Evaporation. Mean.	Evaporation. Diff. from average of 39 years.	Dew Point. Mean.	Dew Point. Diff. from average of 39 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 39 years.	Water of the Thames.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 39 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour. Diff. from average of 39 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
Jan. -	33·2	−3·3	−5·4	31·9	−5·2	29·5	−5·5	9·6	0·0	..	0·163	−0·058	1·9	−0·5
Feb. -	41·8	+3·1	+2·4	40·3	+2·7	38·5	+3·4	11·4	+0·2	..	0·233	+0·020	2·7	+0·3
Mar. -	44·8	+3·2	+3·7	41·8	+3·5	38·9	+2·7	16·2	+1·6	..	0·238	+0·023	2·7	+0·1
Means -	39·8	+1·0	−0·1	38·0	0·0	35·6	+0·2	12·4	+0·6	..	0·211	+0·004	2·4	0·0

1880. Months.	Degree of Humidity. Mean.	Humidity. Diff. from average of 39 years.	Reading of Barometer. Mean.	Barometer. Diff. from average of 39 years.	Weight of a Cubic Foot of Air. Mean.	Weight. Diff. from average of 39 years.	Rain. Amount.	Rain. Diff. from average of 65 years.	Daily Horizontal movement of the Air.	Reading of Thermometer on Grass. Number of Nights it was At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
Jan. -	86	−1	30·204	+0·418	568	+15	0·3	−1·6	179	24	6	1	13·5	49·1
Feb. -	89	+4	29·634	−0·156	548	− 5	2·3	+0·8	346	13	12	4	18·0	46·9
Mar. -	81	−1	29·957	+0·195	551	+ 1	0·6	−1·0	321	14	14	3	18·0	47·1
Means -	85	+1	29·925	+0·162	556	+ 4	Sum 3·2	Sum −1·8	Mean 282	Sum 51	Sum 32	Sum 8	Lowest 13·5	Highest 49·1

Note.—In reading this table it will be borne in mind that the plus sign (+) signifies *above* the average, and that the minus sign (−) signifies *below* the average.

The average duration of the different directions of the wind referred to eight points of the compass, and the duration of each direction in each month in the quarter, was as follows:—

Direction of Wind.	January. Average.	January. 1880.	January. Departure from Average.	February. Average.	February. 1880.	February. Departure from Average.	March. Average.	March. 1880.	March. Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	1½	2	+ ½	2	2	0	2¾	2	− ¾
N.	3	1	−2	3	1	−2	3¼	1	−2¼
N.E.	3¼	5	+1¾	3½	2	−1½	4	5	+1
E.	¾	6	+5¼	2	1	−1	2½	10	+7½
S.E.	2¾	4	+1¼	1¼	2	+ ¾	2	5	+3
S.	4½	1	−3½	3	3	0	2½	1	−1½
S.W.	9¾	7	−2¾	8	9	+1	7¾	3	−4¾
W.	3½	4	+ ½	2½	8	+5½	3¼	4	+ ¾
Calm (nearly.)	2¾	1	−1¾	2½	1	−1½	2½	0	−2½

The sign plus (+) denotes excesses over averages; the largest numbers affected with this sign in the month of January are opposite to the E., in February to the W., and in March both to the E. and S.E.

The sign minus (−) denotes defects below averages; the largest numbers affected with this sign in the month of January are opposite to the N., S., and S.W., in February to the N., and in March both to the N. and S.W.

The fall of rain at Greenwich in January was 0·3 in., being 1·6 ins. below the average; and back to 1815 there is but one instance of so small a fall, viz.:—In the year 1826 when it was 0·3 in. The fall in February was 2·3 ins., being 0·8 in. above the average; and the fall in March was 0·6 in., being 1·0 in. below the average, and there are but nine instances back to 1815 of a smaller fall of rain in the month of March, viz.:—

In 1830 it was 0·3 in.	In 1843 it was 0·5 in.	In 1852 it was 0·2 in.
„ 1837 „ 0·5 in.	„ 1849 „ 0·6 in.	„ 1854 „ 0·4 in.
„ 1840 „ 0·3 in.	„ 1850 „ 0·3 in.	„ 1874 „ 0·5 in.

The fall of rain in the quarter was 3·2 ins., being 1·8 in. below the average.

Thunderstorms occurred on the 8th of February at Cardington; on the 1st of March at Helston, and on the 10th at Cardington.

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING MARCH 31st, 1880.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the sixth edition of his Hygrometrical Tables.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure. Range.	Temperature of Air in Month. Highest.	Temp. Lowest.	Temp. Range.	Temp. Mean Of all Highest.	Temp. Mean Of all Lowest.	Temp. Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity, Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									
GUERNSEY. ADOLPHUS COLLENETTE, Esq., F.M.S.	204	Jan.	30·119	0·557	51·0	27·0	24·0	41·2	34·8	6·4	38·0	35·8	·210	2·4	0·3	92	561	59·4	32·4	1·0	6	11	9	15	1·3	5·6	6	1·02
		Feb.	29·613	1·613	54·0	37·5	16·5	49·6	41·4	8·2	45·0	42·4	·271	3·1	0·3	91	543	80·5	39·0	1·5	4	5	11	9	3·0	5·5	17	4·56
		Mar.	29·841	0·878	61·5	38·0	23·5	53·5	44·2	9·3	48·0	44·2	·290	3·3	0·5	87	544	91·1	42·0	1·4	8	12	7	4	2·2	4·8	8	1·37
HELSTON (Cornwall), MATTHEW P. MOYLE, Esq., M.R.C.S.	106	Jan.	30·461	0·581	58·0	26·0	32·0	49·1	36·0	13·1	42·0	35·7	·211	2·4	0·7	73	553	52·1	32·8	1·8	6	16	6	3	5·4	6·1	6	1·51
		Feb.	29·924	1·866	57·0	31·0	26·0	54·1	38·8	15·3	46·2	40·0	·248	2·9	0·7	80	548	59·2	34·2	2·5	4	4	12	9	6·5	4·7	19	2·78
		Mar.	30·191	0·956	60·0	30·0	30·0	56·0	41·0	15·0	48·0	42·5	·272	3·1	0·7	82	551	67·5	36·4	2·4	2	21	4	4	5·9	4·6	10	2·16
TRURO (Cornwall), C. BARHAM, Esq., M.D., F.M.S.	43	Jan.	30·220	0·559	55·0	22·0	33·0	44·8	34·9	9·9	39·6	35·9	·211	2·4	0·4	87	555	—	—	1·8	6	15	7	3	—	7·3	6	0·85
		Feb.	29·748	1·925	55·0	28·0	27·0	52·0	39·1	12·9	44·9	42·6	·273	3·2	0·2	92	546	—	—	2·7	4	3	11	11	—	7·0	24	4·08
		Mar.	30·089	1·054	59·0	32·0	27·0	53·9	42·2	11·7	46·6	44·5	·294	3·4	0·3	93	549	—	—	2·8	2	16	8	5	—	6·7	17	2·82
PLYMOUTH (Devon), J. MERRIFIELD, Esq., LL.D., F.R.A.S., F.M.S.	63	Jan.	30·348	0·654	52·5	23·2	29·3	42·4	33·8	8·6	37·9	35·3	·207	2·4	0·2	91	565	—	—	1·3	3	14	7	7	—	7·7	8	0·96
		Feb.	29·788	1·784	53·8	32·0	21·8	50·4	39·6	10·8	44·9	42·6	·273	3·2	0·2	92	547	—	—	1·6	5	5	9	10	—	7·6	19	2·93
		Mar.	30·059	1·022	57·2	28·7	28·5	52·7	41·8	10·9	46·5	42·0	·258	3·1	0·6	85	540	—	—	1·8	3	18	4	6	—	6·4	13	1·51
TORQUAY, Babbacombe (Devon), EDWIN E. GLYDE, Esq., F.M.S.	205	Jan.	30·023	0·789	54·0	21·9	32·1	41·7	33·0	8·7	37·3	33·4	·191	2·2	0·4	87	560	65·4	27·9	1·4	7	13	6	5	3·3	7·6	8	1·17
		Feb.	29·462	1·874	54·8	31·0	23·8	50·1	39·4	10·7	44·5	41·5	·262	3·0	0·4	89	541	88·4	32·1	1·7	4	2	12	11	6·1	7·4	23	4·63
		Mar.	29·742	1·105	58·2	30·9	27·3	50·0	40·7	9·3	45·1	41·2	·259	3·0	0·5	86	546	106·7	31·5	1·6	5	16	4	6	5·5	6·6	14	2·16
VENTNOR, (Isle of Wight) (Royal National Hospital for Consumption) HARTLEY SAGAR, Esq.	150	Jan.	30·304	0·668	50·6	24·2	26·4	40·7	33·4	7·3	37·2	33·6	·193	2·2	0·4	87	565	—	—	—	6	15	6	4	3·5	6·9	6	0·57
		Feb.	29·757	1·512	52·8	32·4	20·4	47·8	39·3	8·5	43·2	40·8	·255	2·9	0·3	92	548	—	—	—	7	6	8	12	5·0	7·4	20	3·04
		Mar.	30·032	0·966	59·0	35·3	23·7	51·3	41·2	10·1	43·7	41·6	·264	3·0	0·4	86	550	—	—	—	3	19	3	6	4·6	5·7	6	0·93
OSBORNE (Isle of Wight), J. R. MANN, Esq.	172	Jan.	30·168	0·660	51·2	19·7	31·5	39·3	30·2	9·1	34·4	33·4	·191	2·2	0·1	96	566	56·2	28·3	0·8	8	13	6	4	—	7·0	2	0·28
		Feb.	29·618	1·528	53·4	28·6	24·8	48·2	36·7	11·5	42·2	40·4	·252	2·9	0·2	94	546	76·7	31·0	0·2	2	4	13	10	—	7·3	18	3·05
		Mar.	29·902	1·651	62·6	31·6	31·0	53·4	38·4	15·0	45·4	42·4	·271	3·1	0·4	89	548	99·7	35·6	0·5	4	14	8	5	—	4·6	5	1·03
EASTBOURNE (Sussex), Miss W. L. HALL.	12	Jan.	30·335	0·674	50·7	14·0	36·7	39·2	29·9	9·3	34·9	31·2	·175	2·0	0·1	86	569	55·0	21·2	0·2	12	10	2	7	0·7	—	6	0·52
		Feb.	29·775	1·426	52·9	25·0	27·9	47·2	36·0	11·2	41·7	39·6	·243	2·8	0·2	93	550	77·6	27·7	0·4	6	6	7	10	1·8	—	19	3·46
		Mar.	30·078	1·018	62·2	29·2	33·0	52·8	37·6	15·2	41·8	40·4	·250	2·9	0·5	87	552	107·3	28·5	0·3	3	17	4	7	1·2	—	5	0·81
BOURNEMOUTH, South Bourne, (Hants), T. A. COMPTON, Esq., B.A., M.D., F.M.S.	95	Jan.	30·298	0·668	50·7	18·1	32·6	38·5	30·1	8·4	34·3	30·8	·169	2·0	0·4	85	567	—	—	1·1	11	13	2	5	—	6·4	7	0·91
		Feb.	29·702	1·566	52·4	26·4	26·0	46·7	38·2	8·5	42·2	39·6	·243	2·8	0·3	90	548	—	—	1·5	5	5	9	10	—	6·3	22	3·37
		Mar.	29·988	1·088	58·2	26·6	31·6	52·0	38·1	13·9	44·7	39·3	·240	2·8	0·6	81	551	—	—	1·6	6	16	2	7	—	4·7	8	0·69
BRIGHTON (Sussex), F. E. SAWYER, Esq., F.M.S.	206	Jan.	30·164	0·673	49·2	19·3	29·9	38·1	29·5	8·6	34·0	30·7	·172	2·0	0·3	87	593	—	27·2	0·7	10	12	4	5	—	6·0	4	0·58
		Feb.	29·613	1·505	52·0	29·6	22·4	46·3	37·3	9·0	41·7	39·5	·245	2·8	0·2	93	547	—	32·8	1·0	5	4	10	10	—	8·4	18	2·61
		Mar.	29·899	1·098	60·0	31·0	29·0	51·5	38·7	12·8	44·8	38·3	·232	2·7	0·7	78	549	—	33·3	1·1	7	12	6	6	—	5·0	6	0·86
SALISBURY (Wilton House), Wilts, T. CHALLIS, Esq.	166	Jan.	30·170	0·690	55·0	9·5	45·5	38·1	24·7	13·4	31·8	29·2	·160	1·9	0·2	90	582	51·8	21·6	1·1	9	13	3	6	—	7·2	4	0·38
		Feb.	29·690	1·546	55·0	24·0	31·0	49·2	32·8	16·4	41·3	38·6	·234	2·7	0·3	91	547	72·0	32·1	1·5	6	5	9	9	—	7·5	23	4·04
		Mar.	29·884	1·092	65·5	22·0	43·5	56·5	34·9	21·6	45·0	41·1	·257	2·9	0·5	86	549	95·1	34·7	1·3	6	14	3	8	—	5·9	7	0·74
BARNSTAPLE (Devon), WILLIAM KNILL, Esq.	43	Jan.	30·312	0·650	54·0	20·0	34·0	42·1	31·8	10·3	37·2	33·1	·189	2·2	0·4	87	564	—	—	1·0	5	16	6	4	—	5·2	6	0·71
		Feb.	29·713	1·920	57·0	29·0	28·0	51·9	40·2	11·7	43·8	41·9	·266	3·0	0·5	86	544	—	—	1·3	4	4	15	6	—	4·5	24	4·25
		Mar.	30·015	1·500	66·0	30·0	36·0	56·6	41·5	15·1	48·1	41·6	·262	3·0	0·8	78	547	—	—	1·4	3	13	9	6	—	4·8	15	1·72
CATERHAM (Surrey), The Metropolitan Asylum, G. STANLEY ELLIOT, Esq., M.D.	608	Jan.	29·635	0·690	52·0	13·2	38·8	36·9	27·3	9·6	32·4	29·9	·167	1·9	0·2	90	558	—	18·3	1·5	6	10	8	7	—	5·8	7	0·87
		Feb.	29·120	1·320	52·5	28·0	24·5	46·1	34·9	11·2	40·7	37·3	·223	2·6	0·4	88	540	—	24·3	2·2	3	3	9	14	—	6·8	18	3·17
		Mar.	29·403	1·080	62·4	30·2	32·2	51·2	36·7	14·5	43·4	37·7	·220	2·6	0·6	80	542	—	24·8	1·8	4	16	5	6	—	4·9	5	0·77

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean. Of all Highest.	Temperature of Air in Month. Mean. Of all Lowest.	Temperature of Air in Month. Mean. Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a Cubic foot of Air. Mean.	Vapour. In a Cubic foot of Air. Short of Saturation.	Mean Degree of Humidity, Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
STRATHFIELD TURGISS (Hants), Rev. C. H. Griffith, M.A., F.M.S.	197	Jan.	30·168	0·693	54·0	13·1	40·9	37·9	26·1	11·8	32·2	29·0	·160	1·9	0·3	87	560	49·4	23·3	0·7	6	13	6	6	1·1	6·5	4	0·58
		Feb.	29·601	1·562	54·4	22·3	32·1	48·8	35·4	13·4	42·0	39·8	·245	2·8	0·3	92	546	76·4	31·9	1·1	4	4	8	13	2·0	7·9	20	3·61
		Mar.	29·896	0·932	64·3	22·3	42·0	55·3	35·6	19·7	45·2	38·5	·233	2·7	0·7	78	549	94·0	30·4	1·3	6	14	3	8	1·8	5·6	4	0·94
BATH (Somerset), St. Gregory's College, Downside, Rev. T. L. Almond, O.S.B., F.M.S.	596	Jan.	29·695	0·670	51·9	14·5	37·4	38·4	28·4	10·0	33·0	30·3	·169	2·0	0·2	90	559	59·7	26·3	1·1	5	10	8	8	—	6·8	10	0·69
		Feb.	29·120	1·757	54·0	30·6	23·4	47·4	37·2	10·2	41·9	39·5	·243	2·9	0·2	92	558	81·8	35·1	1·5	3	2	13	11	—	7·1	22	5·81
		Mar.	29·460	1·119	62·4	27·0	35·4	53·3	36·5	16·8	43·6	39·7	·245	2·8	0·4	86	542	92·2	33·5	1·3	5	14	6	6	—	6·3	11	3·06
MARLBOROUGH (Wilts), Rev. Thomas A. Preston, M.A., F.M.S.	474	Jan.	29·878	0·654	53·5	8·6	44·9	38·5	27·3	11·2	32·1	29·8	·166	2·0	0·1	91	563	55·1	22·6	0·3	6	10	8	7	—	6·3	8	0·51
		Feb.	29·272	1·472	54·2	27·3	26·9	48·1	36·1	12·0	41·7	39·0	·239	2·8	0·3	91	541	79·4	30·2	0·5	3	4	13	10	—	7·5	26	3·76
		Mar.	29·575	1·120	61·9	24·6	37·3	53·8	36·2	17·6	44·3	39·1	·239	2·8	0·6	82	544	99·3	29·7	0·8	4	16	4	7	—	6·5	8	1·84
BLACKHEATH (London), James Glaisher, Esq., F.R.S.	160	Jan.	30·263	0·732	54·5	15·0	39·5	37·6	27·4	10·2	32·9	29·6	·164	1·9	0·3	87	569	56·0	24·8	0·5	5	11	6	9	—	6·9	7	0·33
		Feb.	29·631	1·496	53·9	23·3	30·6	47·5	35·6	11·9	41·7	37·9	·228	2·6	0·4	87	548	81·3	32·0	1·2	3	3	9	14	—	6·8	17	2·36
		Mar.	29·928	1·202	66·0	27·0	39·0	54·2	36·3	17·9	44·3	38·6	·234	2·7	0·6	80	550	100·9	32·3	1·1	5	15	5	6	—	3·4	5	0·48
STREATLEY (Berks), "The Vicarage," Rev. J. Slatter, M.A., F.R.S., F.M.S.	150	Jan.	30·217	0·675	58·7	15·0	43·7	38·3	28·0	10·3	33·0	30·9	·173	2·0	0·2	92	569	—	—	0·6	8	12	6	5	—	6·9	5	0·44
		Feb.	29·647	1·380	55·2	25·9	29·3	48·2	35·5	12·7	42·0	39·3	·241	2·8	0·3	91	548	—	—	1·5	4	7	11	7	—	7·5	20	3·02
		Mar.	29·916	1·146	65·2	23·6	41·6	55·4	36·5	18·9	45·2	40·0	·247	2·8	0·6	82	550	—	—	1·4	6	13	6	6	—	6·7	6	1·12
CAMDEN SQUARE (London), G. J. Symons, Esq., F.R.S., F.M.S.	123	Jan.	30·248	0·731	55·4	19·2	36·2	37·7	29·5	8·2	33·5	30·9	·173	2·0	0·3	90	569	48·7	26·4	—	8	5	6	12	—	6·6	5	0·31
		Feb.	29·665	1·449	53·7	27·0	26·7	47·8	35·9	11·9	41·9	39·0	·239	2·8	0·3	90	548	68·4	31·8	—	5	1	10	13	—	7·2	19	2·33
		Mar.	29·974	1·182	62·6	28·7	33·9	54·4	37·0	17·4	44·7	39·5	·243	2·8	0·6	82	551	91·3	32·3	—	10	10	5	6	—	6·4	5	0·79
OXFORD (The Observatory), E. J. Stone, Esq., M.A., F.R.S.	210	Jan.	30·152	0·892	53·5	15·8	37·7	37·4	27·4	10·0	32·5	30·6	·172	2·0	0·2	93	568	56·3	25·7	0·8	6	9	7	9	0·4	6·8	5	0·38
		Feb.	29·545	1·640	54·9	25·0	29·9	48·2	36·4	11·8	42·4	39·2	·239	2·7	0·4	88	545	74·8	34·3	1·6	2	3	13	11	1·3	7·3	22	2·38
		Mar.	29·870	1·227	62·2	26·9	35·3	53·1	36·5	16·6	44·7	37·5	·225	2·6	0·7	76	549	96·9	33·6	1·2	5	13	6	7	3·0	6·0	5	1·40
ROYSTON (Hertfordshire), Hale Wortham, Esq., F.R.A.S., F.M.S.	269	Jan.	30·095	0·722	53·8	15·1	38·7	37·8	27·3	10·5	32·9	29·9	·167	1·9	0·3	88	567	—	—	—	4	6	11	10	—	6·8	5	0·22
		Feb.	29·514	1·404	53·9	27·7	26·2	47·9	34·7	13·2	41·5	37·9	·227	2·6	0·4	88	546	—	—	—	3	2	14	10	—	6·4	17	1·98
		Mar.	29·835	1·236	64·5	22·8	41·7	54·1	33·3	20·8	43·2	37·7	·226	2·6	0·6	81	550	—	—	—	8	13	5	5	—	5·9	4	1·05
BEDFORD, Cardington, Mr. J. McLaren, Assistant to S. C. Whitbread, Esq., M.P.	105	Jan.	30·287	0·900	53·4	13·0	40·4	37·7	28·0	9·7	32·8	30·4	·170	1·9	0·2	91	569	40·7	23·4	0·6	7	5	8	11	—	7·1	4	0·30
		Feb.	29·638	1·760	55·6	25·0	30·6	48·3	34·2	14·1	41·0	39·1	·239	2·8	0·2	93	548	60·8	28·5	2·0	4	1	9	15	—	6·7	15	2·00
		Mar.	29·967	1·280	62·4	25·0	37·4	53·4	35·0	18·4	43·5	38·3	·231	2·7	0·6	81	552	79·2	29·2	1·5	3	17	3	8	—	5·3	6	1·70
CAMBRIDGE (Trinity College), J. W. L. Glaisher, Esq., M.A., F.R.S.	40	Jan.	30·310	0·788	56·3	16·0	40·3	39·1	29·1	10·0	34·2	31·5	·178	2·1	0·3	89	569	60·2	25·7	0·8	7	4	11	9	—	6·0	10	0·24
		Feb.	29·718	1·598	56·0	25·0	31·0	49·3	37·0	12·3	42·8	39·5	·243	2·8	0·4	84	548	85·5	31·4	1·4	4	1	15	9	—	6·7	18	1·61
		Mar.	30·045	1·196	64·3	23·8	40·5	55·5	33·9	21·6	45·8	38·2	·230	2·7	0·6	80	553	108·2	30·7	1·1	6	12	8	5	—	4·6	7	0·87
RUGBY (Warwickshire), Stockton, "The Rectory," W. Tuckwell, Esq.	289	Jan.	30·014	0·758	54·0	12·0	42·0	37·6	26·9	10·7	32·8	31·4	·177	2·0	0·2	95	565	41·1	24·4	0·2	8	8	11	4	5·1	6·5	6	0·49
		Feb.	29·472	1·522	54·5	26·0	28·5	47·3	33·9	13·4	40·6	38·6	·234	2·8	0·2	93	546	52·0	30·1	0·5	3	4	14	8	7·3	7·5	21	2·50
		Mar.	29·755	1·234	63·0	24·0	39·0	54·0	34·7	19·3	43·1	39·6	·244	2·8	0·4	87	548	62·7	31·2	0·4	6	15	6	4	7·0	5·1	5	1·88
LOWESTOFT (Suffolk), S. H. Miller, Esq., F.R.A.S., F.M.S.	85	Jan.	30·262	0·852	55·5	16·7	38·8	39·3	30·7	8·6	35·0	31·7	·178	2·1	0·3	87	567	53·3	27·8	0·5	6	6	6	13	—	7·0	5	0·07
		Feb.	29·650	1·514	54·7	31·0	23·7	44·3	34·8	9·5	40·0	37·2	·222	2·6	0·3	90	551	72·2	32·0	1·0	3	3	9	14	—	6·3	17	1·66
		Mar.	30·007	1·370	60·0	29·0	31·0	48·7	37·2	11·5	42·6	38·7	·235	2·7	0·5	86	554	87·7	35·1	0·6	5	14	4	8	—	6·1	7	0·85
SOMERLEYTON (Suffolk), The Rectory, Rev. C. J. Steward, F.M.S.	50	Jan.	30·313	0·862	56·2	13·7	42·5	38·1	30·3	8·5	34·6	32·8	·187	2·2	0·2	93	568	—	—	0·9	5	6	10	10	4·8	6·6	7	0·21
		Feb.	29·733	1·552	56·2	28·7	27·5	45·7	35·5	10·2	40·8	39·2	·239	2·9	0·2	92	550	—	—	1·2	3	3	14	9	6·5	6·2	17	1·84
		Mar.	30·062	1·416	59·0	27·0	32·0	47·7	37·8	9·9	42·6	38·7	·235	2·7	0·5	86	555	—	—	1·2	8	13	4	6	7·1	5·5	8	0·68
WOLVERHAMPTON (Staffordshire), Wrottesley, E. Simpson, Esq.	500	Jan.	29·791	0·818	53·8	15·6	38·2	37·1	28·3	8·8	32·8	29·8	·166	1·9	0·2	88	561	—	—	—	3	8	13	7	—	8·4	4	0·54
		Feb.	29·187	1·420	52·5	28·5	24·0	45·9	34·7	11·2	40·1	37·6	·225	2·6	0·3	91	541	—	—	—	2	4	13	10	—	8·3	21	2·81
		Mar.	29·535	1·400	59·8	26·0	33·8	50·3	34·3	16·0	41·0	37·8	·227	2·6	0·4	89	547	—	—	—	1	17	6	7	—	8·3	4	0·81

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean. Of all Highest.	Temperature of Air in Month. Mean. Of all Lowest.	Temperature of Air in Month. Mean. Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity, Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
NORWICH (Norfolk), The Literary Institution, JOHN QUINTON, Esq., Jun.	42	Jan.	30.323	0.876	56.0	19.0	37.0	39.0	31.5	7.5	34.9	32.8	.187	2.2	0.2	92	568	—	—	—	3	5	15	8	—	—	3	0.07
		Feb.	29.728	1.498	54.0	30.0	24.0	47.3	38.0	9.3	42.1	39.3	.241	2.8	0.4	89	549	—	—	—	2	3	16	8	—	—	14	1.83
		Mar.	30.081	1.336	59.5	29.0	30.5	59.5	37.5	12.8	43.1	35.7	.255	2.7	0.5	84	554	—	—	—	7	14	5	5	—	—	4	0.78
LEICESTER (Town Museum), W. J. HARRISON, Esq., F.G.S.	238	Jan.	30.083	0.823	54.8	17.0	37.8	39.6	30.6	9.0	34.8	31.1	.174	2.0	0.3	86	564	52.9	21.1	0.7	3	5	13	10	—	7.9	7	0.69
		Feb.	29.457	1.462	56.8	23.9	33.9	47.6	37.2	10.4	42.0	37.9	.229	2.6	0.5	86	544	71.9	29.0	1.2	4	2	11	12	—	7.6	18	2.35
		Mar.	29.813	1.390	61.2	24.8	36.4	51.8	36.1	15.7	43.4	37.9	.228	2.6	0.6	81	539	91.5	27.3	0.8	6	13	6	6	—	7.7	6	0.78
NOTTINGHAM (Notts), M. O. TARBOTTON, Esq., C.E., F.G.S., F.M.S.	183	Jan.	30.132	0.836	55.7	14.0	41.7	38.7	29.4	9.3	34.0	30.9	.174	2.0	0.3	88	564	56.9	28.9	0.2	6	10	9	6	0.5	7.5	7	0.74
		Feb.	29.523	1.458	55.2	27.9	27.3	47.8	35.2	12.6	41.2	38.5	.233	2.7	0.3	91	546	66.1	32.8	0.4	5	3	12	9	2.1	6.3	21	1.87
		Mar.	29.890	1.456	63.7	25.9	37.8	51.9	35.6	16.3	42.4	38.2	.231	2.7	0.5	86	552	81.6	34.6	0.4	3	18	5	5	0.8	6.8	7	1.12
LLANDUDNO (Carnarvonshire), JAMES NICOL, Esq., M.D., and THOMAS DALTON, Esq., M.D.	100	Jan.	30.204	0.920	56.0	24.2	31.8	42.6	34.5	8.1	38.8	33.4	.192	2.2	0.5	82	552	—	—	0.5	4	4	12	11	—	5.8	4	0.70
		Feb.	29.560	1.750	55.2	32.0	23.2	49.6	40.0	9.6	44.8	39.6	.244	2.8	0.6	82	[illegible]	—	—	1.1	5	3	8	15	—	5.3	19	1.75
		Mar.	29.938	1.510	59.5	31.7	27.8	51.8	38.7	13.1	45.0	38.7	.235	2.7	0.7	79	550	—	—	0.9	2	10	12	7	—	4.7	6	2.14
KELSTERN GRANGE, near Louth (Lincolnshire), D. GRANT BRIGGS, Esq., F.M.S.	393	Jan.	29.910	0.943	54.3	16.9	37.4	37.5	29.1	8.4	33.0	30.6	.171	2.0	0.2	91	563	60.0	—	1.0	5	4	10	12	6.4	6.5	8	0.17
		Feb.	29.298	1.521	52.4	30.0	22.4	46.1	34.8	11.3	40.0	37.5	.225	2.6	0.3	91	543	76.3	31.7	1.5	2	3	15	11	8.0	5.9	19	2.20
		Mar.	29.673	1.516	56.1	25.0	31.1	47.0	34.6	12.4	40.5	37.5	.227	2.6	0.4	90	550	87.9	31.7	1.0	5	14	7	5	8.1	6.3	6	2.01
LIVERPOOL, The Observatory, JOHN HARTNUP, Esq., F.R.A.S.	107	Jan.	30.104	0.904	55.8	19.7	36.1	40.1	32.2	7.9	36.0	32.5	.186	2.1	0.4	87	563	—	—	1.0	4	12	9	6	—	6.6	6	1.06
		Feb.	29.467	1.884	53.4	29.4	24.0	48.2	37.9	10.3	42.6	38.5	.233	2.7	0.4	86	544	—	—	1.3	1	7	12	9	—	6.8	19	1.25
		Mar.	29.840	1.528	58.5	31.0	27.5	50.7	37.4	13.3	43.0	37.3	.223	2.6	0.6	81	550	—	—	1.3	1	17	8	5	—	5.8	6	1.57
BOLTON, Sharples (Lancashire), REV. T. MACKERETH, F.R.A.S., F.M.S.	481	Jan.	29.775	0.884	53.0	10.7	42.3	38.6	25.3	13.3	33.1	28.7	.158	1.9	0.3	87	570	45.0	22.9	0.6	4	7	12	8	2.8	7.2	7	0.74
		Feb.	29.143	1.552	52.0	24.0	28.0	46.1	32.1	14.0	40.0	36.5	.216	2.5	0.4	88	540	52.5	30.8	2.7	3	3	13	10	6.7	7.0	23	2.92
		Mar.	29.521	1.496	58.2	25.0	33.2	51.3	30.7	20.6	41.2	35.8	.210	2.4	0.6	82	546	66.5	28.4	1.5	3	13	9	6	4.0	6.7	11	3.88
HALIFAX, Bermerside Observatory (Yorkshire), E. J. CROSSLEY, Esq., F.R.A.S.	530	Jan.	29.790	0.880	51.8	19.0	32.8	39.4	31.2	8.2	35.2	31.1	.174	2.1	0.3	84	558	51.3	27.1	0.4	3	7	7	14	—	6.8	4	0.46
		Feb.	—	—	52.5	28.0	24.5	46.8	36.1	10.7	41.2	36.7	.218	2.5	0.5	84	—	73.6	32.2	0.9	2	5	11	11	—	7.2	19	3.39
		Mar.	—	—	60.0	27.5	32.5	48.1	35.5	12.6	40.7	36.2	.213	2.5	0.5	85	—	76.9	33.6	0.6	2	17	7	5	—	7.1	10	2.06
HULL (Yorkshire), The People's Park, MR. E. PEAKE.	12	Jan.	30.337	0.988	55.0	21.0	34.0	39.1	29.9	9.2	35.2	31.1	.174	2.1	0.3	84	568	—	—	1.4	6	6	9	10	2.3	8.0	6	0.38
		Feb.	29.697	1.488	54.0	30.0	24.0	46.8	35.3	11.5	41.8	36.6	.219	2.5	0.6	83	549	62.2	35.6	2.3	4	2	14	9	—	5.4	16	1.94
		Mar.	30.089	1.338	57.0	27.0	30.0	49.1	34.9	14.2	42.5	35.8	.211	2.4	0.7	78	555	73.1	32.2	1.1	3	16	5	7	1.7	7.4	10	2.76
STONYHURST (Lancashire), REV. S. J. PERRY, F.R.S., F.M.S., F.R.A.S.	363	Jan.	29.928	0.933	55.0	17.0	34.0	39.3	29.0	10.3	34.2	29.0	.160	1.9	0.4	81	562	57.7	27.0	—	4	7	12	8	—	7.1	9	0.88
		Feb.	29.284	1.398	55.3	26.8	28.5	47.8	36.1	11.7	41.3	38.0	.229	2.6	0.4	89	542	81.3	33.1	—	1	2	14	12	—	8.2	26	3.76
		Mar.	29.627	1.540	55.9	27.8	28.1	50.8	34.7	16.1	41.1	38.1	.230	2.7	0.5	88	548	91.5	33.1	—	4	15	6	6	—	6.6	12	3.17
BRADFORD (Yorkshire), J. McLANDSBOROUGH, Esq., C.E., F.G.S.	366	Jan.	29.918	0.972	54.3	20.8	33.5	40.6	32.2	8.4	36.7	31.8	.181	2.1	0.5	83	559	43.9	—	1.1	6	8	9	8	—	6.8	9	0.91
		Feb.	29.290	1.424	52.8	28.0	24.8	47.4	37.9	9.5	42.5	38.1	.230	2.6	0.5	85	540	52.1	—	1.6	3	4	7	15	—	7.2	21	2.56
		Mar.	29.648	1.534	55.1	32.9	22.2	48.5	37.1	11.4	41.7	37.0	.221	2.5	0.5	85	548	60.7	—	1.3	3	11	9	8	—	6.6	15	2.76
LEEDS (Yorkshire), The Philosophical Hall, H. CROWTHER, Esq.	137	Jan.	30.189	0.940	57.0	19.0	38.0	42.7	32.0	10.7	38.0	31.6	.178	2.1	0.6	78	562	46.9	—	1.7	4	9	4	14	—	3.7	3	0.05
		Feb.	29.542	1.668	56.0	28.0	28.0	49.7	37.3	12.4	44.0	37.9	.228	2.6	0.7	78	543	57.5	—	2.3	4	5	8	12	—	4.2	20	1.95
		Mar.	29.919	1.540	60.0	32.0	28.0	51.1	37.3	13.8	43.4	37.5	.224	2.6	0.6	80	551	61.0	—	2.2	3	15	5	8	—	3.3	8	2.75
COCKERMOUTH (Cumberland), H. DODGSON, Esq., M.D., F.M.S., F.R.A.S.	146	Jan.	30.130	1.014	52.1	17.5	34.6	40.8	32.9	7.9	36.7	33.3	.191	2.2	0.4	88	563	49.1	28.0	0.6	4	9	10	8	1.3	7.2	10	1.32
		Feb.	29.483	1.702	51.6	27.4	24.2	47.5	38.9	8.6	42.8	38.8	.236	2.7	0.5	86	543	71.1	31.6	0.8	3	5	11	10	3.2	7.5	24	4.02
		Mar.	29.871	1.618	62.0	25.3	36.7	52.7	34.6	18.1	43.0	35.7	.210	2.4	0.8	76	551	92.6	27.6	0.4	3	13	7	8	1.5	5.4	10	1.70
SILLOTH (Cumberland), "The Rectory," REV. F. REDFORD, M.A., F.R.A.S., F.M.S.	28	Jan.	30.257	1.115	51.2	18.5	32.7	40.2	32.0	8.2	36.2	31.8	.180	2.1	0.5	84	566	60.0	27.8	1.0	3	11	8	9	6.8	6.6	11	1.01
		Feb.	29.611	1.810	50.9	28.9	22.0	46.7	37.1	9.6	41.7	36.5	.235	2.7	0.4	89	547	77.6	32.9	1.5	3	5	9	12	9.2	6.1	19	2.95
		Mar.	30.016	1.681	60.3	27.2	33.1	49.9	34.9	15.0	41.4	36.9	.220	2.5	0.5	85	555	90.3	29.9	1.4	3	16	5	7	8.3	5.1	8	1.82

NAMES of STATIONS and OBSERVERS.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Lowest.	Range.	Mean Of all Highest.	Mean Of all Lowest.	Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	In a cubic foot of Air. Mean.	In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Sats. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									In.
CARLISLE, Spital (Cumberland), ISAAC CARTMEL, Esq., F.M.S.	114	Jan.	30·162	1·052	53·6	15·3	38·3	39·7	29·2	10·5	34·7	31·8	·180	2·1	0·3	89	566	47·5	25·3	1·0	5	13	6	7	2·7	7·0	8	1·33
		Feb.	29·506	1·660	55·3	28·3	27·0	48·2	36·5	11·7	42·2	39·1	·259	2·7	0·4	80	545	69·5	30·6	1·7	2	7	8	12	5·2	6·2	21	1·98
		Mar.	29·917	1·678	58·8	21·8	37·0	51·7	32·3	19·4	40·9	35·9	·211	2·5	0·5	83	554	110·1	26·4	1·1	4	15	5	7	3·1	4·3	9	1·22
NORTH SHIELDS (Northumberland), ROBERT SPENCE, Esq.	124	Jan.	30·227	1·142	57·2	22·2	35·0	39·3	31·9	7·4	35·6	32·8	·188	2·2	0·3	90	566	—	31·5	1·3	9	4	4	14	—	5·4	4	0·38
		Feb.	29·560	1·475	52·3	29·0	23·3	46·1	36·8	9·3	41·3	37·5	·225	2·6	0·4	87	547	—	36·5	1·7	7	3	7	12	—	5·5	15	1·49
		Mar.	30·012	1·753	56·0	27·6	28·4	45·9	36·9	9·0	40·6	37·7	·226	2·6	0·3	90	556	—	36·3	1·6	7	8	8	8	—	6·8	9	1·64
WARINGSTOWN, Co. Down (Ireland), THOMAS WARING, Esq.	191	Jan.	29·977	1·026	54·0	16·0	38·0	42·0	32·8	9·2	37·7	34·4	·199	2·3	0·4	88	559	59·4	30·0	2·3	4	4	14	9	—	5·6	11	1·22
		Feb.	29·400	1·968	56·0	27·0	29·0	48·8	35·6	13·2	42·0	39·3	·241	2·8	0·3	91	543	73·4	32·3	2·7	3	2	10	11	—	4·9	23	2·67
		Mar.	29·744	1·534	61·0	28·0	33·0	53·0	35·6	17·4	43·7	38·3	·231	2·7	0·6	81	548	86·5	33·4	2·5	2	12	11	6	—	4·1	11	2·24

Second Rain-gauges are placed—

			January.		February.		March.		Total in Quarter.
At Beachy Head, at the height of	515 feet *above the sea*, the amount collected was		0·44 inches.	-	2·25 inches.	-	0·68 inches.	-	3·37 inches.
,, ,, ,,	495 ,, ,,	,,	0·42 ,,	-	3·20 ,,	-	0·66 ,,	-	4·28 ,,
,, Strathfield Turgiss, ,,	58 ,, *ground*	,,	0·35 ,,	-	2·54 ,,	-	0·69 ,,	-	3·58 ,,
,, Oxford, ,,	22 ,, ,,	,,	0·46 ,,	-	2·33 ,,	-	1·28 ,,	-	4·07 ,,
,, Cardington, ,,	36 ,, ,,	,,	0·25 ,,	-	1·80 ,,	-	1·40 ,,	-	3·45 ,,
,, Nottingham, ,,	39 ,, ,,	,,	0·67 ,,	-	1·66 ,,	-	1·04 ,,	-	3·37 ,,

NOTE.—*Barometer Reading*, BRADFORD, February 17th, at 3h. p.m., 29·723 inches, has been altered to 28·723 inches.
,, WARINGSTOWN, ,, 19th, at 3h. p.m., 29·618 ,, ,, 28·618 ,,

Thunder was heard but lightning was not seen on the 8th of February at Somerleyton; on the 12th at Helston; on the 14th and 17th at Bolton, and on the 25th at Somerleyton; on the 10th of March at Streatley, and on the 15th at Guernsey.

Lightning was seen but thunder was not heard on the 2nd of January at Liverpool; on the 13th February at North Shields; on the 3rd of March at Somerleyton and Stonyhurst, and on the 4th and 13th at Cambridge.

Solar halos were seen on the 15th of January at Royston; on the 16th at Torquay; on the 6th of February at Torquay; on the 10th at Torquay, Strathfield, and Oxford; on the 12th at Halifax; on the 17th at Halifax and Stonyhurst, and on the 27th at Torquay and Halifax; on the 1st of March at Halifax; on the 13th at Strathfield; on the 26th and 27th at Torquay, and on the 29th at Oxford.

Lunar halos were seen on the 27th of January at Halifax and Stonyhurst; on the 16th of February at Oxford, Royston, Cambridge, and Kelstern; on the 17th at Oxford and Strathfield; on the 20th and 21st at Strathfield; on the 25th at Guernsey and Torquay; on the 26th at Halifax; on the 25th of March at Bath, and on the 26th at Bournemouth and Bath.

Snow fell on the 10th of January at Royston, Stockton, and Cambridge; on the 13th at Torquay, Osborne, Salisbury, Bath, Marlborough, Streatley, Oxford, Cardington, Stockton, Wolverhampton, and North Shields; on the 14th at Bournemouth, Marlborough, Royston, Wellington, Stockton, Cambridge, Leicester, and Liverpool; on the 15th at Torquay, Bath, Cardington, Somerleyton, Stockton, Norwich, Cambridge, Kelstern, Halifax, Stonyhurst, Carlisle, and North Shields; on the 16th at Marlborough and North Shields; on the 17th at Stockton, Kelstern, Bolton, and Silloth; on the 18th at Cardington, Norwich, Bolton, Halifax, and Stonyhurst; on the 19th at Leicester; on the 20th at Torquay; on the 21st at Royston; on the 22nd at Royston, Norwich, and Cambridge; on the 23rd at Bath, Marlborough, Streatley, Oxford, and Stockton; and on the 24th at Torquay; on the 9th of February at Halifax; on the 12th at Torquay and Bolton; on the 17th at Stockton and Kelstern; on the 24th at Norwich; on the 26th at Bolton and Halifax; on the 1st of March at Bath, Bolton, Halifax, Leeds, and Carlisle; on the 2nd at Liverpool, Bolton, Llandudno, Halifax, Hull, Stonyhurst, and Leeds; and on the 22nd at Royston.

Hail fell on the 14th of January at Ramsgate; on the 8th of February at Guernsey and Bath; on the 9th at Guernsey and Torquay; on the 12th at Guernsey, Helston, Truro, Salisbury, Cardington, and Stockton; on the 16th at Streatley; on the 17th at Torquay and Salisbury; on the 18th at Torquay; on the 19th at Guernsey and Torquay; on the 20th at Torquay, Bath, and Cambridge; on the 22nd at Strathfield; on the 26th at Royston, Stockton, Bolton, Llandudno, Stonyhurst, and Carlisle; on the 1st of March at Guernsey, Helston, Plymouth, Torquay, Streatley, Llandudno, Halifax, and Stonyhurst; on the 2nd at Wolverhampton, Llandudno, and Halifax; on the 3rd and 4th at Halifax; on the 14th and 21st at Hull; and on the 31st at Guernsey.

Fog prevailed on 21 different days in January, 16 days in February, and on 21 days in March, or on 58 different days during the quarter.

Names of Stations.	Mean Pressure of dry Air reduced to the level of the Sea.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind: Mean Estimated Strength.	Wind: Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°							
Guernsey	29·827	51·5	27·0	31·5	48·1	40·1	21·3	8·0	43·7	40·8	·257	3·3	0·4	90	549	77·0	37·8	1·3	6	9	9	6	2·2	[illegible]
Helston	—	55·0	21·0	34·0	51·1	38·6	20·3	11·5	45·1	39·4	·244	2·8	0·7	80	554	59·6	34·5	2·2	4	14	7	5	5·9	5·1
Truro	29·811	59·0	22·0	37·0	50·2	38·7	27·0	11·5	43·7	41·0	·259	3·0	0·3	91	553	—	—	2·4	4	11	9	6	—	7·0
Plymouth	29·815	57·2	23·2	34·0	48·5	38·1	[illegible]	10·1	43·1	40·0	·249	2·9	0·3	84	554	—	—	1·6	4	12	7	8	—	7·2
Torquay	29·81	58·2	21·9	[illegible]	47·7	37·7	37·7	9·6	42·[illegible]	38·7	·237	2·7	0·4	87	549	81·5	31·5	1·6	5	10	7	7	5·0	7·2
Ventnor	29·901	53·0	24·5	31·8	45·6	38·0	33·5	8·6	42·0	38·7	·237	2·7	0·4	88	554	—	—	—	4	13	6	7	4·4	6·7
Osborne	29·845	52·6	10·7	[illegible]	47·0	35·1	[illegible]	11·5	40·7	38·7	·238	2·7	0·2	93	553	77·5	22·0	0·5	5	10	9	6	—	6·[illegible]
Eastbourne	29·873	62·2	14·0	48·2	46·4	[illegible]	27·5	11·9	40·5	37·1	·233	2·6	0·4	88	557	73·6	25·8	0·3	7	11	4	8	1·2	—
Bournemouth	29·873	58·2	18·1	40·1	45·7	35·5	30·1	10·2	40·4	36·4	·217	2·5	0·4	85	555	—	—	1·1	7	11	4	7	—	5·8
Brighton	29·880	60·0	19·3	40·7	45·5	35·2	27·1	10·1	40·2	37·2	·216	2·5	0·4	85	554	—	31·8	0·9	7	9	7	7	—	6·5
Salisbury	29·875	65·5	9·5	56·0	47·2	31·8	40·0	17·1	40·4	35·5	·217	2·5	0·3	89	555	73·0	20·8	1·3	7	11	5	5	—	7·2
Barnstaple	29·821	65·0	[illegible]	45·0	50·2	37·8	32·5	12·4	43·7	38·9	·239	2·7	0·3	81	552	—	—	1·2	4	11	10	5	—	6·8
Caterham	29·846	62·4	[illegible]	49·2	44·7	[illegible]	[illegible]	11·8	38·8	35·0	[illegible]	2·4	0·4	86	547	—	22·5	1·8	4	10	7	9	—	5·8
Ramsgate	29·882	51·5	22·0	29·5	46·0	35·6	27·7	10·4	40·5	38·1	[illegible]	2·7	0·3	91	556	77·7	—	1·2	4	10	8	8	—	5·[illegible]
Strathfield Turgiss	29·894	64·3	[illegible]	50·2	47·3	32·4	[illegible]	14·9	39·8	35·8	·213	2·5	0·4	86	555	73·2	28·5	1·0	5	10	6	9	1·6	6·7
Bath	29·853	62·4	14·5	47·9	46·4	34·5	32·1	12·4	[illegible]	35·5	·210	2·6	0·3	86	546	77·2	31·6	1·3	4	9	9	8	—	6·7
Marlborough	29·874	61·9	8·6	53·3	47·8	33·2	[illegible]	13·6	39·4	36·0	·213	2·5	0·5	88	549	77·9	27·5	0·5	4	10	8	8	—	6·8
Blackheath	29·884	65·0	[illegible]	51·0	46·1	33·1	[illegible]	[illegible]	39·6	35·4	·220	2·4	0·4	85	553	79·4	29·7	0·9	4	10	7	10	—	6·4
Streatley	29·884	65·2	[illegible]	50·2	[illegible]	[illegible]	38·2	14·0	[illegible]	36·7	·220	2·5	0·4	88	556	—	—	1·2	6	11	8	6	—	7·[illegible]
Camden Square	29·873	62·6	[illegible]	49·4	45·6	34·1	[illegible]	12·5	[illegible]	36·5	·218	2·5	0·4	87	556	69·5	30·2	—	8	5	7	10	—	6·7
Oxford	29·877	62·2	15·8	46·4	47·2	33·4	[illegible]	12·8	[illegible]	36·4	[illegible]	2·4	0·1	85	551	76·0	31·2	1·2	4	8	9	9	1·5	6·7
Royston	29·907	64·5	15·1	49·4	46·0	32·8	35·5	14·8	39·2	35·2	·207	2·4	0·4	86	551	—	—	—	5	7	10	8	—	6·4
Cardington	29·847	62·4	[illegible]	49·4	45·5	32·4	[illegible]	14·1	39·1	35·9	·213	2·5	0·3	88	558	60·2	27·0	1·4	5	8	7	11	—	6·4
Cambridge	29·851	64·3	16·0	48·3	[illegible]	[illegible]	[illegible]	14·7	[illegible]	36·4	·217	2·5	0·4	86	557	84·6	29·3	1·1	6	6	11	8	—	5·8
Rugby	29·846	64·0	12·0	51·0	[illegible]	31·8	[illegible]	14·5	38·8	35·5	·218	2·5	0·3	92	553	51·9	28·6	0·4	6	9	10	5	0·5	6·4
Lowestoft	29·934	59·0	15·7	43·3	44·1	31·2	31·2	9·9	39·2	35·9	·212	2·5	0·4	88	557	71·1	31·6	0·7	5	8	6	12	—	6·[illegible]
Somerleyton	29·872	53·0	13·7	[illegible]	44·1	34·5	31·0	9·6	[illegible]	33·9	[illegible]	2·6	0·3	90	558	—	—	1·1	5	7	9	8	0·1	6·1
Wolverhampton	29·843	57·8	[illegible]	41·2	44·4	32·4	32·0	12·0	[illegible]	35·1	[illegible]	2·4	0·3	89	550	—	—	—	2	10	11	8	—	5·[illegible]
Norwich	29·860	59·5	19·0	40·5	45·5	35·7	31·5	9·8	40·1	33·9	·221	2·6	0·4	88	557	—	—	—	1	7	12	7	—	—
Leicester	[illegible]	61·2	17·0	44·2	[illegible]	31·6	[illegible]	[illegible]	40·1	35·6	·210	2·4	0·5	81	552	72·0	27·8	0·9	4	6	10	9	—	7·7
Nottingham	29·858	[illegible]	14·6	[illegible]	[illegible]	[illegible]	[illegible]	12·7	[illegible]	35·9	·213	[illegible]	0·1	88	555	68·3	32·1	0·3	5	10	9	7	1·1	6·[illegible]
Llandudno	29·788	59·5	24·2	[illegible]	48·0	37·7	27·6	[illegible]	[illegible]	[illegible]	·224	2·6	0·6	81	552	—	—	0·8	3	6	11	11	—	5·[illegible]
Liverpool	29·890	58·5	19·7	38·8	[illegible]	35·8	[illegible]	10·5	40·5	[illegible]	·224	2·5	0·5	85	[illegible]	—	—	1·2	2	12	10	7	—	6·2
Bolton	29·809	58·2	10·7	47·5	45·3	29·4	34·5	16·0	[illegible]	[illegible]	·195	2·3	0·4	81	543	54·0	27·4	1·6	3	8	11	8	4·5	7·[illegible]
Halifax	—	50·0	[illegible]	[illegible]	41·8	[illegible]	20·9	[illegible]	[illegible]	35·7	·202	2·4	0·1	84	—	67·[illegible]	31·0	0·6	2	10	8	10	—	7·[illegible]
Hull	29·843	57·0	21·0	36·0	45·0	33·4	[illegible]	11·6	[illegible]	34·5	·201	2·3	0·5	82	557	—	—	1·6	4	8	9	9	—	6·[illegible]
Stonyhurst	29·820	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12·7	[illegible]	35·0	[illegible]	2·4	0·4	86	551	76·8	31·1	—	3	8	11	9	—	7·[illegible]
Bradford	29·814	55·1	20·8	[illegible]	43·5	[illegible]	[illegible]	9·5	[illegible]	[illegible]	·211	2·4	0·5	84	549	52·2	—	1·3	4	8	8	10	—	6·[illegible]
Leeds	29·825	[illegible]	19·0	41·0	[illegible]	[illegible]	[illegible]	12·5	41·8	37·7	·210	2·4	0·6	79	552	55·1	—	2·1	4	10	6	11	—	5·7
Cockermouth	29·779	52·0	17·5	41·5	42·0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	·212	2·4	0·6	85	552	70·9	29·1	0·6	3	9	9	9	2·0	6·7
Silloth	29·781	59·3	15·5	[illegible]	45·3	34·7	20·3	10·9	[illegible]	35·7	·212	2·4	0·5	85	556	76·0	30·0	1·3	3	11	7	9	8·1	5·[illegible]
Carlisle	29·774	58·8	[illegible]	43·5	43·5	32·7	31·1	13·8	[illegible]	35·6	[illegible]	2·4	0·4	87	555	75·7	26·8	1·3	4	12	6	9	3·5	5·8
North Shields	—	57·2	22·2	35·0	43·8	35·2	28·9	8·6	39·2	36·0	[illegible]	2·5	0·3	89	551	—	31·8	1·5	8	5	6	11	—	5·9

The highest temperatures of the air were at Barnstaple and Blackheath, both 65°·0; Salisbury, 65°·5; Streatley, 65° Royston, 64°·5.

The lowest temperatures of the air were at Marlborough, 8°·6; Salisbury, 9°·5; Bolton, 10°·7; Rugby, 12°·0; and Cardington, 1

The greatest daily ranges of the temperatures of the air were at Salisbury, 17°·1; Bolton, 16°·0; Strathfield Turgiss, 14° Royston, 14°·8.

The least daily ranges of the temperatures of the air were at Guernsey, 8°·0; North Shields, 8°·6; and Torquay and Som both 9°·6.

The greatest number of rainy days were at Truro and Stonyhurst, both 47; Torquay, Barnstaple, and Bradford, 45; and mouth, 44.

The least number of rainy days were at Norwich, 21; Ramsgate, 2[illegible]; Osborne and Cardington, both 25; and Royston, 26.

The heaviest falls of rain were at Bath, 9·56 inches; Stonyhurst, 7·81 inches; Truro, 7·75 inches; and Bolton, 7·06 inches.

The least falls of rain were at Ramsgate, 1·94 inches; Lowestoft, 2·58 inches; Cambridge, 2·72 inches; and Somerleyton, 2·73

Quarterly Meteorological Table for different Parallels of Latitude.

Parallels of Latitude, &c.	Mean Pressure of dry Air reduced to the level of the Sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind: Mean Estimated Strength.	Wind: Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°							
Guernsey	29·827	61·5	27·0	31·5	48·1	40·1	21·3	8·0	43·7	40·8	·257	3·3	0·4	90	549	77·0	37·8	1·3	6	9	6	6	2·2	[illegible]
Between the latitudes 50° and 51°	29·868	[illegible]	21·8	37·5	48·0	37·2	27·8	10·8	42·2	38·6	·237	2·7	0·4	87	553	75·5	32·6	1·5	5	11	7	7	3·1	[illegible]
51° and 52°	29·871	63·6	15·1	48·5	46·9	33·7	34·6	[illegible]	40·1	36·5	·218	2·5	0·4	87	553	73·6	28·9	1·2	5	10	8	8	1·6	[illegible]
52° and 53°	29·852	61·7	15·2	46·5	45·8	33·4	34·4	12·4	39·3	37·0	·214	2·5	0·4	88	555	68·0	29·2	0·8	5	8	10	8	4·6	[illegible]
53° and 54°	29·815	58·0	18·9	39·1	46·1	34·4	30·0	11·7	40·2	35·3	·208	2·4	0·5	83	552	61·1	29·8	1·2	3	9	9	9	4·5	[illegible]
54° and 55°	29·779	60·4	17·1	43·3	46·4	34·3	31·7	12·1	40·0	35·7	·211	2·4	0·5	85	551	74·2	28·6	1·1	3	11	7	9	4·6	[illegible]
Mean for the [illegible] Year 1877	29·566	58·0	21·7	36·3	48·3	36·7	31·3	11·6	42·4	38·3	·243	2·7	0·5	86	547	70·0	31·6	1·3	6	3	8	13	4·9	[illegible]
" 1878	29·917	59·5	24·0	35·5	47·5	35·5	31·7	11·0	41·7	37·6	·226	2·6	0·5	86	554	70·0	31·8	1·1	8	4	6	12	4·1	[illegible]
" 1879	29·644	58·9	16·4	42·5	42·5	31·6	31·8	10·7	36·6	33·3	·192	2·3	0·3	87	554	62·4	27·6	1·1	7	10	6	7	4·2	[illegible]
" 1880	29·837	60·6	17·6	43·0	46·0	34·6	31·7	12·0	40·4	36·4	·218	2·5	0·4	86	553	70·9	29·8	1·2	4	10	8	8	4·1	[illegible]

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING JUNE 30, 1880.

Remarks on the Weather during the Quarter ending June 30th, 1880.

By James Glaisher, Esq., F.R.S., *&c.*

The weather in April was variable. For a few days at the beginning of the month, the warm period which set in on February 6th continued, accompanied by strong S.W. winds. On April 6th the temperature declined below the average, the wind changed to the N.E., and remained there till the 16th; the wind then changed to the S.W., and the weather for a week was genial and warm; after this it suddenly became cold again, and the remainder of the month was ungenial with strong N.E. winds. The month was showery and the amount of rain was somewhat in excess of the average all over the country, but upon the whole it was a fine April month, very favourable for agricultural work, following as it did a dry March.

The first half of the month of May was cold; N. and N.E. winds, at times blowing very strongly, were prevalent till the 21st day; then S.W. winds prevailed till the 30th, and the wind was again N.E. on the last day. The weather was generally fine and dry with occasional bright and warm sunshine, and there was very little rain. The nights were generally cold, the reading of the thermometer with its bulb on grass falling frequently below 32° at night.

At the end of the month vegetation was somewhat backward, but the prospects were considered favourable.

The month of June was unsettled; the first half was very cold, with strong N. and N.E. winds for a few days at the beginning; then there were S.W. winds, but the cold continued; then N. and N.E. winds again; from the 18th the winds were mostly from the S.S.W. and W.S.W., and the weather was warmer. Till the 26th, with the exception of three or four days, rain fell daily, from the 19th to the 26th thunderstorms were frequent, with heavy rain and hail, causing much damage to crops.

At the end of the month pastures and green crops looked well, having benefited a good deal by the frequent gentle rain, and wheat, which came into ear at many places about the end of the month, was progressing favourably.

Till the 5th of April the average daily temperature was 3° in excess of the general average for these days; from the 6th to the 16th the weather was cold, the average daily deficiency of temperature being 1°·8; from the 17th to the 24th it was warm, the average daily excess of temperature being 4°·3; it was cold from April 25th to May 11th, the average daily deficiency for these 17 days being 4°·0; from May 12th to May 27th the weather was mostly warm, the average daily excess for these 16 days being 3°·1; from May 28th to June 12th, every day was cold, then for a day or two the temperatures were nearly equal to their averages; then it was cold again till June 26th; for these 30 days the average daily deficiency of temperature was 2½°, the last four days of the quarter were warm, the daily excess of temperature being 3½°.

In the neighbourhood of London *the readings of the barometer* were below their averages from the 1st to the 16th of April, with the exception of the 8th, 9th, 10th, and 11th, on which days they were a little above, the mean amount of defect for the 16 days being 0·18 in. From the 17th of April to the 2nd of June the readings of the barometer were above their average values, except on eight days, when the readings were slighly in defect, the mean amount of excess for these 47 days being 0·14 in. The readings were below their averages from the 3rd of June till the 11th, except on the 5th, when the value was 0·02 in. in excess of the average, the mean amount of defect for the 9 days being 0·12 in.; there were now six days of excess of pressure, viz., from the 12th to the 17th, the mean amount of excess for these six days being 0·08 in. From the 18th of June to the end of the quarter (with the exception of the 27th, 28th, and 29th), the mean daily readings were below their averages to the mean amount of 0·12 in.

The mean reading for the month of April was 29·701 ins., being 0·054 in. below the average of the preceding 39 years. The mean reading for the month of May was 29·910 ins., being 0·127 in. above the average; and higher than any reading since 1876. The mean reading for the month of June was 29·733 ins., being 0·075 in. below the average, and 0·092 in. above the value in 1879. The atmospheric pressure in April was less than in March by 0·236 in., that in May was greater than in April by 0·209 in., and that in June was less than in May by 0·177 in. (From the preceding 39 years' observations the *mean pressure* in April is greater than in March by 0·013 in., that in May is greater than in April by 0·028 in., and that in June is greater than in May by 0·025 in.)

The mean decrease of *pressure*, from all stations, from March to April was 0·222 in.: from April to May the mean increase was 0·237 in.: and from May to June the mean decrease was 0·178 in.

At *Greenwich* the *mean temperature* of April was higher than that of March by 2°·8, that of May was higher than that of April by 5°·5, and that of June was higher than that of May by 4°·9. (From the preceding 39 years' observations the *mean temperature* of April is higher than that of March by 5°·5, that of May is higher than that of April by 5°·5, and that of June is higher than that of May by 6°·4.)

The increase of *mean temperature* from March to April South of latitude 51° was 1°·3, between 51° and 52° was 1°·7, and North of 52° was 3°·1; the increase from April to May was very nearly the same everywhere, the mean from all places being 4°·3, and the further increase from May to June South of latitude 52° was 3°·9, and North of this latitude was 5°·6.

The mean temperature of the air for April was 47°·1, being 1° above the average of *preceding 109 years,* and the same as the average of the preceding 39 years. It was 3°·9 hi *than the value in 1879.*

The mean temperature of the air for May was 52°·6, being 0°·1 above the average of the preceding 109 years, and the same as the average of the preceding 39 years. It was 4°·2 higher than the value recorded in 1879.

The mean temperature of the air for June was 57°·5, being 0°·7 and 1°·5, respectively, below the averages of the preceding 109 years, and 39 years. It was 0°·6 higher than the value in 1879.

The mean temperature of the air for the quarter was 52°·4, being 0°·1 above the average of the preceding 109 years, and 0°·5, below the average of the preceding 39 years. It was 2°·9 higher than the value in 1879.

The mean high day temperatures of the air were 1°·8, 0°·2 and 3°·0, respectively, below their averages in April, May, and June.

The mean low night temperatures of the air were 1°·6, and 0°·5, respectively, below their averages in May and June, but 0°·7 above in April. Therefore the days were cold and the nights were warm in April; the nights were cold in May, and in June the days were cold, and the nights moderately cold.

1880. Months.	Temperature of: Air. Mean.	Air. Diff. from average of 109 years.	Air. Diff. from average of 39 years.	Evaporation. Mean.	Evaporation. Diff. from average of 39 years.	Dew Point. Mean.	Dew Point. Diff. from average of 39 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 39 years.	Water of the Thames.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 39 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour. Diff. from average of 39 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
April	47·1	+1·0	0·0	44·1	+0·1	40·7	+0·2	16·0	−2·5	..	0·254	+0·001	2·9	−0·1
May	52·6	+0·1	0·0	48·3	−0·5	44·0	−1·1	21·8	+1·4	..	0·288	−0·010	3·3	−0·2
June	57·5	−0·7	−1·5	54·5	−0·1	51·7	+1·1	18·6	−2·5	..	0·384	+0·014	4·3	+0·1
Means	52·4	+0·1	−0·5	49·0	−0·2	45·5	+0·1	18·8	−1·2	..	0·309	+0·002	3·5	−0·1

1880. Months.	Degree of Humidity. Mean.	Degree of Humidity. Diff. from average of 39 years.	Reading of Barometer. Mean.	Reading of Barometer. Diff. from average of 39 years.	Weight of a Cubic Foot of Air. Mean.	Weight of a Cubic Foot of Air. Diff. from average of 39 years.	Rain. Amount.	Rain. Diff. from average of 65 years.	Daily Horizontal movement of the Air.	Reading of Thermometer on Grass. Number of Nights it was At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
April	79	+1	29·701	−0·054	543	0	2·2	+0·4	333	6	20	4	26·4	45·5
May	73	−3	29·910	+0·127	541	0	0·5	−1·6	281	11	12	8	22·8	47·0
June	82	+8	29·733	−0·075	531	− 1	2·3	+0·3	252	0	6	24	30·5	53·2
Means	78	+2	29·781	−0·001	538	0	Sum 5·0	Sum −0·9	Mean 289	Sum 17	Sum 38	Sum 36	Lowest 22·8	Highest 53·2

Note.—In reading this table it will be borne in mind that the plus sign (+) signifies *above* the average, and that the minus sign (−) signifies *below* the average.

The average duration of the different directions of the wind referred to eight points of the compass, and the duration of each direction in each month in the quarter, were as follows:—

Direction of Wind.	April. Average.	April. 1880.	April. Departure from Average.	May. Average.	May. 1880.	May. Departure from Average.	June. Average.	June. 1880.	June. Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	2¼	1	−1¼	1¼	3	+1¾	2	1	−1
N.	4	0	−4	4¼	2	−2¼	3¼	2	−1¼
N.E.	6	3	−3	7	10	+3	3½	7	+3½
E.	3½	8	+4½	2½	6	+3½	2¼	5	+2¾
S.E.	2	2	0	1¾	2	+ ¼	1½	2	+ ½
S.	2½	3	+ ½	2¾	0	−2¾	2¼	2	− ¼
S.W.	6¼	6	− ¼	7½	3	−4½	10	5	−5
W.	2½	7	+4½	2	5	+3	3¾	7	+3¼
Calm (nearly.)	1	0	−1	2	0	−2	1½	0	−1½

The plus sign (+) denotes excesses over averages; the largest numbers affected with this sign in the month of April are opposite to the E. and W., in May to the N.E., E., and W., and in June to the N.E. and W.

The minus sign (−) denotes defects below averages; the largest numbers affected with this sign in the month of April are opposite to the N. and N.E., in May to the S. and S.W., and in *June to the S.W.*

The mean daily ranges of temperature were 2°·5 less than their averages in April and June, *and 1°·4 greater in May.*

The fall of rain at Greenwich in April was 2·2 ins., being 0·4 in. above the average; the fall in May was 0·5 in., being 1·6 in. below the average, and back to 1815 there are but five instances of so small a fall of rain in May as that in the present year, viz.:—

In 1833 it was 0·2 in.	In 1844 it was 0·4 in.	In 1848 it was 0·4 in.
„ 1870 „ 0·5 in.	„ 1874 „ 0·4 in.	

The fall in June was 2·3 ins., being 0·3 in. above the average; the total fall of rain in the quarter was 5·0 ins., being 0·9 in. below the average.

Thunderstorms occurred on the 3rd of April at Somerleyton; on the 5th at Cardington, Somerleyton, Bolton, Halifax, and Hull; on the 6th at Caterham, Strathfield, Streatley, and Hull; on the 7th at Somerleyton, Halifax, and Stonyhurst; on the 8th at Osborne, Royston, Cardington, and Cambridge; on the 13th at Bolton; on the 22nd at Royston and North Shields; on the 25th at Kelstern and Hull, and on the 26th at Guernsey. On the 3rd of May at London and Osborne; on the 15th at Osborne; on the 26th at Torquay, Royston, and Cardington, and on the 28th at Ramsgate and Royston. On the 7th of June at Somerleyton, Stockton, and Bywell; on the 8th at Somerleyton and Leeds; on the 11th at Bolton; on the 19th at Liverpool and Hull; on the 21st at Cardington; on the 22nd at Stockton and Leeds; on the 23rd at Oxford; on the 24th at Cardington, Stockton, and Halifax; on the 25th at Oxford; and on the 26th at Osborne, Bath, and Hull.

Thunder was heard but lightning was not seen on the 3rd of April at Lowestoft and Hull; on the 4th at North Shields; on the 5th at Royston, Leicester, Wolverhampton, Kelstern, and North Shields; on the 6th at London, Royston, Cardington, Stockton, Leicester, Wolverhampton, Kelstern, Carlisle, and North Shields; on the 7th at Bath, Wolverhampton, Hull, and North Shields; on the 8th at Strathfield, London, and Stockton; on the 13th at Stonyhurst; on the 16th at Halifax and Hull; on the 20th at Wolverhampton; on the 21st at Stonyhurst; on the 22nd at Cardington, Cambridge, and Bywell, and on the 25th at North Shields. On the 3rd of May at Stockton and Wolverhampton; on the 15th at Torquay; on the 19th at Bywell; on the 25th at Stonyhurst; on the 26th at Guernsey, Somerleyton, Stockton, Cambridge, and Kelstern; on the 27th at Ramsgate and Bywell; and on the 28th at Cardington, Somerleyton, Cambridge, Wolverhampton, Kelstern, and Hull. On the 7th of June at Oxford, Hull, Carlisle, and North Shields; on the 8th at Oxford, Hull, Carlisle, and Bywell; on the 9th at Wolverhampton, Liverpool, Llandudno, Halifax, Hull, and Bywell; on the 10th at Wolverhampton, Liverpool, Bolton, Hull, Silloth, Bywell, and North Shields; on the 11th at Wolverhampton, Llandudno, and Hull; on the 14th at Strathfield, Royston, and Cardington; on the 15th at Guernsey; on the 19th at Torquay, Cardington, Somerleyton, Stockton, and Llandudno; on the 20th at Llandudno; on the 21st at Carlisle and North Shields; on the 22nd at Strathfield, Marlborough, Royston, Cardington, Cambridge, Bolton, Liverpool, Llandudno, Halifax, Hull, Silloth, and Carlisle; on the 23rd at Oxford, Somerleyton, Stockton, Cambridge, and Wolverhampton; on the 24th at Royston, Somerleyton, Cambridge, Wolverhampton, and Hull; on the 25th at London, Royston, Wolverhampton, and North Shields; and on the 26th at London, Stockton, and North Shields.

Lightning was seen but thunder was not heard on the 3rd of May at Plymouth and Torquay; on the 13th at Guernsey; on the 26th at Bath, Marlborough, London, Oxford, and Cambridge; on the 27th at Ramsgate; and on the 28th at Guernsey. On the 9th of June at Liverpool; on the 18th at Plymouth; on the 20th at Liverpool; on the 22nd at Torquay; on the 23rd at Cambridge; on the 24th at London and Cambridge; on the 25th at Cambridge and Hull; and on the 26th at Torquay.

Solar halos were seen on the 1st, 4th, 6th, and 8th of April at Torquay; on the 14th at Halifax and Stonyhurst; and on the 17th, 24th, and 27th at Torquay. On the 2nd of May at Halifax; on the 5th at Bywell; on the 10th and 11th at Torquay; on the 13th at Bath and Stonyhurst; on the 18th at Stonyhurst; on the 25th at Torquay; on the 27th at Torquay and Halifax; and on the 30th at Halifax. On the 5th of June at Torquay; on the 20th at Strathfield; on the 22nd at Torquay and Liverpool; on the 23rd at Torquay; on the 24th at Stockton and Halifax; on the 27th at Liverpool and Halifax; on the 29th at Halifax; and on the 30th at Strathfield.

Aurora Borealis was seen on the 8th and 14th of April at North Shields.

Snow fell on the 26th of April at both Torquay and Streatley.

Hail fell on the 1st of April at London, Stockton, and Carlisle; on the 4th at Truro and Stockton; on the 5th at Guernsey, Truro, Plymouth, Torquay, Strathfield, Royston, Wolverhampton, Halifax, and Leeds; on the 6th at Truro, Torquay, Strathfield, Stonyhurst, and North Shields; on the 7th at Plymouth, Somerleyton, and Stonyhurst; on the 8th at Strathfield, Streatley, Cardington, and Cambridge; on the 11th at Torquay; on the 13th at Cardington; on the 15th at Torquay; on the 16th at Bath and Cardington; on the 22nd at Plymouth, Bath, Cardington, Stockton, Cambridge, and North Shields; on the 25th at Kelstern, Halifax Hull, Carlisle, and Bywell; on the 26th at Guernsey, Torquay, Royston, Cambridge, Kelstern, Bolton, Halifax, Hull, Leeds, and North Shields; and on the 29th at Cambridge. On the 3rd of May at Osborne; on the 11th at Strathfield and Wolverhampton; on the 24th at Silloth; on the 25th and 27th at Carlisle; and on the 28th at Royston, Cardington, Somerleyton, and Hull. On the 4th and 6th of June at North Shields; on the 7th at Royston, Bolton, Liverpool, and North Shields; on the 8th at Stockton, Leeds, and Carlisle; on the 21st at Bywell; on the 22nd at Cambridge; on the 23rd and 24th at Stockton; and on the 26th at Bath.

Lunar halos were seen on the 19th of April at Leicester; and on the 23rd at Torquay, Cambridge, and Stonyhurst. On the 8th of May at Torquay; on the 18th at Bath; on the 20th at Bath and North Shields; and on the 22nd at Torquay, Oxford, Halifax, and Stonyhurst. On the 22nd of June at Torquay.

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING JUNE 30TH, 1880.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the sixth edition of his Hygrometrical Tables.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure Range.	Temperature of Air in Month. Highest.	Lowest.	Range.	Mean of all Highest.	Mean of all Lowest.	Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	In a cubic foot of Air. Mean.	In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Sat.=100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Minimum on Grass.	Wind. Estimated Strength.	Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									
GUERNSEY, Adolphus Collenette, Esq., F.M.S.	204	April	29·647	0·938	60·0	41·0	19·0	54·4	44·2	10·2	48·1	42·9	·275	3·2	0·6	83	539	97·0	41·5	1·6	8	7	7	8	2·9	4·6	16	2·84
		May	29·850	0·858	76·5	38·5	38·0	60·8	47·2	13·6	52·2	45·7	·308	3·5	1·0	79	540	105·3	44·0	1·4	13	10	3	5	1·8	3·4	1	0·03
		June	29·713	0·821	69·5	42·5	27·0	62·3	51·2	11·1	54·4	50·4	·364	4·1	0·7	86	535	102·2	49·2	1·2	9	7	6	8	1·0	5·5	18	1·75
TRURO (Cornwall), C. Barham, Esq., M.D., F.M.S.	43	April	29·834	1·054	61·0	31·0	30·0	55·4	42·2	13·2	47·0	43·4	·282	3·3	0·4	88	545	—	—	2·7	8	8	5	9	—	6·2	14	5·56
		May	30·040	0·777	68·0	31·0	37·0	63·5	44·7	18·8	51·7	44·3	·291	3·3	1·0	76	544	—	—	2·3	8	10	8	5	—	4·9	5	1·35
		June	29·883	0·760	71·0	36·0	35·0	64·4	49·8	14·6	54·0	50·0	·360	4·1	0·6	86	538	—	—	2·2	10	4	8	8	—	7·2	18	2·23
PLYMOUTH (Devon), J. Merrifield, Esq., LL.D., F.R.A.S., F.M.S.	69	April	29·873	1·084	60·8	36·6	24·2	54·5	43·3	11·2	47·8	41·9	·265	3·0	0·7	81	545	—	—	1·8	10	5	7	8	—	6·7	12	2·68
		May	30·083	0·804	76·3	36·4	39·9	62·5	46·3	16·2	53·4	44·6	·295	3·4	1·2	72	541	—	—	1·6	10	11	4	6	—	4·8	5	1·03
		June	29·935	0·768	70·4	40·3	30·1	63·9	51·6	12·3	56·6	50·8	·372	4·2	0·8	81	536	—	—	1·6	9	6	6	9	—	7·6	16	1·22
TORQUAY, Babbacombe (Devon), Edwin E. Glyde, Esq., F.M.S.	305	April	29·550	1·117	62·0	37·0	25·0	53·8	41·4	12·4	46·8	40·5	·252	2·9	0·8	78	540	125·8	35·0	1·7	8	8	6	8	5·6	6·6	18	1·87
		May	29·764	0·828	75·1	34·3	40·8	60·3	44·8	15·5	51·5	43·8	·286	3·3	1·0	75	539	135·0	36·8	1·3	10	9	5	7	4·2	4·9	8	0·84
		June	29·619	0·757	72·7	38·4	34·3	63·5	50·0	13·5	55·3	49·8	·358	4·1	0·8	82	532	132·5	44·5	1·2	9	6	6	9	4·9	7·1	17	2·29
VENTNOR, (Isle of Wight) (Royal National Hospital for Consumption), W. T. Ryder, Esq.	150	April	29·794	1·066	59·0	37·0	22·0	54·1	43·1	11·0	47·3	41·6	·263	3·1	0·7	81	544	—	—	—	6	9	6	9	5·1	6·4	14	1·87
		May	30·003	0·758	73·6	37·5	36·1	61·0	46·3	14·7	52·0	47·0	·323	3·7	0·7	83	543	—	—	—	7	14	4	6	5·0	4·0	7	0·56
		June	29·833	0·710	68·9	43·2	25·7	63·3	50·4	12·9	55·9	52·2	·392	4·4	0·6	87	535	—	—	—	5	6	9	10	5·2	6·8	14	2·03
OSBORNE (Isle of Wight), J. R. Mann, Esq.	172	April	29·683	1·090	66·0	34·5	31·5	56·4	41·0	15·4	48·1	43·7	·284	3·3	0·5	85	541	107·7	38·2	1·9	7	7	8	8	—	6·6	12	1·43
		May	29·885	0·834	79·0	32·7	46·3	65·5	43·4	22·1	52·7	49·3	·352	4·0	0·5	89	540	120·7	39·4	1·1	8	11	6	6	—	5·8	7	0·32
		June	29·730	0·672	76·1	39·7	36·4	67·8	49·7	18·1	57·0	54·5	·425	4·7	0·5	90	532	117·2	46·8	1·2	7	5	9	9	—	7·1	14	2·73
EASTBOURNE (Sussex), Miss W. L. Hall.	12	April	29·778	1·020	64·0	35·3	28·7	56·2	41·5	14·7	48·1	41·8	·264	3·0	0·8	79	543	109·5	31·4	0·3	5	8	5	12	1·8	—	13	1·94
		May	30·020	0·628	76·8	34·7	42·1	63·5	43·6	19·9	52·5	45·4	·304	3·4	1·1	77	543	117·2	33·1	0·4	10	9	4	8	1·5	—	2	0·09
		June	29·848	0·636	77·0	39·6	37·4	67·4	50·6	16·8	57·8	55·3	·439	4·8	0·5	92	·533	118·8	40·1	0·2	7	7	4	12	3·4	—	19	2·78
BOURNEMOUTH, South Bourne, (Hants), T. A. Compton, Esq., B.A., M.D., F.M.S.	128	April	29·756	1·094	60·0	34·7	25·3	53·5	41·5	12·0	46·6	40·6	·254	3·0	0·7	81	535	—	—	1·9	8	8	7	7	—	5·3	15	2·20
		May	29·984	0·796	75·1	32·1	43·0	60·9	42·8	18·1	51·3	41·1	·259	2·9	1·3	68	543	—	—	1·6	10	10	5	6	—	4·4	4	0·33
		June	29·816	0·700	68·1	38·6	29·5	62·5	49·9	12·6	55·2	49·1	·350	3·9	1·0	81	536	—	—	1·2	6	7	9	8	—	6·4	16	2·14
BRIGHTON (Sussex), F. E. Sawyer, Esq., F.M.S.	206	April	29·656	1·055	61·2	36·4	24·8	54·6	41·2	13·4	47·3	39·3	·240	2·8	1·0	74	542	93·5	37·4	0·9	8	6	9	7	—	6·6	14	1·65
		May	29·864	0·807	72·0	36·0	36·0	60·9	44·5	16·4	51·8	41·1	·258	2·9	1·4	67	542	106·5	41·2	1·0	9	8	9	5	—	6·8	5	0·30
		June	29·712	0·647	74·6	38·0	36·6	66·0	49·8	16·2	57·2	50·9	·371	4·2	1·1	79	532	108·0	47·6	0·6	8	4	9	9	—	7·9	14	1·37
SALISBURY (Wilton House), Wilts, T. Challis, Esq.	186	April	29·694	1·108	64·0	29·0	35·0	57·6	37·1	20·5	46·6	40·4	·252	2·9	0·7	80	543	99·3	36·0	1·2	6	8	8	13	—	6·6	15	1·79
		May	29·890	0·774	78·5	26·5	52·0	66·5	37·9	28·6	51·4	43·3	·281	3·2	1·1	74	542	109·4	36·5	1·2	11	9	3	8	—	5·5	5	0·40
		June	29·733	0·678	78·0	35·5	42·5	69·2	46·2	23·0	56·0	50·2	·365	4·1	0·9	81	533	111·9	45·4	1·2	10	4	5	11	—	7·5	20	2·21
BARNSTAPLE (Devon), William Knill, Esq.	43	April	29·822	1·080	65·0	36·0	29·0	55·8	44·5	11·3	48·7	41·4	·262	3·0	0·9	76	543	—	—	1·3	7	9	6	8	—	4·8	15	2·62
		May	30·042	0·800	73·0	38·0	35·0	64·8	48·6	16·2	55·0	44·6	·295	3·3	1·6	69	540	—	—	1·2	11	6	7	7	—	2·8	8	1·61
		June	29·881	0·750	75·0	40·0	35·0	66·9	53·5	13·6	58·0	51·7	·385	4·3	1·2	80	534	—	—	1·1	7	4	10	9	—	4·7	12	1·71

NAMES of STATIONS and OBSERVERS.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean Of all Highest.	Temperature of Air in Month. Mean Of all Lowest.	Temperature of Air in Month. Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a Cubic foot of Air. Mean.	Vapour. In a Cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
CATERHAM (Surrey), The Metropolitan Asylum, G. STANLEY ELLIOT, ESQ., M.D.	608	April	29·076	—	62·0	32·4	29·6	52·6	38·9	13·7	45·3	37·8	·297	2·6	0·9	76	534	—	30·4	1·9	7	8	6	9	—	5·1	14	2·02
		May	29·417	0·600	78·0	31·6	46·4	59·7	42·0	17·7	50·2	41·6	·263	3·0	1·1	73	534	—	36·3	1·7	11	11	2	7	—	3·1	7	0·48
RAMSGATE (Kent), REV. E. DOUGLAS O'GARA, O.S.B., F.M.S.	108	April	29·776	1·094	63·0	37·4	25·6	53·9	42·2	11·7	47·4	43·8	·286	3·3	0·5	89	544	101·9	—	1·3	3	9	11	7	—	6·5	11	1·60
		May	29·967	0·883	80·0	40·0	40·0	60·6	45·0	15·6	51·5	48·5	·341	3·8	0·5	89	542	110·4	—	1·2	7	15	4	5	—	6·5	4	0·15
		June	29·799	0·586	74·0	43·0	31·0	64·0	48·6	15·4	55·4	52·6	·398	4·5	0·5	91	535	110·4	—	1·0	6	7	7	10	—	7·8	15	4·32
STRATHFIELD TURGISS (Hants), REV. C. H. GRIFFITH, M.A., F.M.S.	197	April	29·664	1·117	65·1	32·4	32·7	55·8	39·3	16·5	46·7	40·1	·248	2·9	0·7	79	544	102·3	33·4	1·5	7	8	4	11	2·0	6·5	13	1·71
		May	29·877	0·774	78·5	29·1	49·4	64·1	40·9	23·2	51·5	41·8	·265	3·0	1·2	70	541	114·9	35·0	1·3	10	10	3	8	2·0	5·9	9	0·64
		June	29·708	0·686	75·5	36·0	39·5	67·0	47·8	19·2	56·2	50·2	·364	4·1	0·9	80	533	117·9	43·4	1·2	7	5	6	12	2·8	7·2	19	2·80
BATH (Somerset), St. Gregory's College, Downside, REV. T. L. ALMOND, O.S.B., F.M.S.	506	April	29·233	1·110	58·0	31·0	27·0	51·5	38·8	12·7	44·2	39·4	·242	2·8	0·5	83	537	99·9	35·3	1·5	8	7	8	7	—	6·5	19	2·25
		May	29·431	0·758	74·0	32·8	41·2	60·6	41·6	19·0	50·0	42·0	·267	3·0	1·1	75	535	112·3	38·4	1·2	9	9	6	7	—	5·0	7	0·68
		June	29·291	0·710	70·0	40·5	29·5	62·5	48·3	14·2	53·8	49·9	·358	4·1	0·6	87	528	112·5	46·1	1·2	7	5	8	10	—	7·2	20	2·24
MARLBOROUGH (Wilts), REV. THOMAS A. PRESTON, M.A., F.M.S.	474	April	29·366	1·127	62·2	31·2	31·0	53·8	38·9	14·9	45·2	38·9	·237	2·7	0·7	79	539	105·1	32·4	1·0	5	8	7	10	—	6·1	19	2·54
		May	29·585	0·760	74·9	33·0	41·9	61·5	41·4	20·1	50·3	41·5	·262	3·0	1·2	72	537	116·1	34·1	0·9	8	11	3	9	—	5·2	7	0·55
		June	29·411	0·668	74·0	36·2	37·8	65·2	48·0	17·2	56·1	49·9	·361	4·1	1·0	80	528	117·9	42·6	—	7	6	6	11	—	8·2	19	1·73
BLACKHEATH (London), JAMES GLAISHER, ESQ., F.R.S.	160	April	29·705	1·145	67·8	33·1	34·7	55·8	39·1	16·7	46·5	40·7	·254	3·0	0·7	82	544	103·6	35·7	1·2	2	11	7	10	—	6·2	14	2·21
		May	29·907	0·805	87·2	31·9	55·3	63·8	41·9	21·9	51·6	44·4	·293	3·3	1·0	76	542	127·8	37·4	1·1	9	12	2	8	—	5·3	4	0·58
		June	29·734	0·601	80·3	38·9	41·4	67·6	48·3	19·3	56·2	50·4	·367	4·1	0·9	81	533	122·3	44·2	0·7	6	10	5	10	—	6·6	18	2·38
STREATLEY (Berks), "The Vicarage," REV. J. SLATTER, M.A., F.R.S., F.M.S.	150	April	29·709	1·147	64·8	29·8	35·0	56·0	39·0	17·0	47·4	40·4	·251	2·9	0·9	77	544	—	—	2·3	7	7	7	9	—	6·7	16	1·93
CAMDEN SQUARE (London), G. J. SYMONS, ESQ., F.R.S., F.M.S.	123	April	29·745	1·148	67·4	34·3	33·1	57·0	40·9	16·1	47·7	39·9	·246	2·8	1·0	75	543	100·4	36·7	—	10	5	7	8	—	6·7	17	2·15
		May	29·958	0·752	85·0	33·8	51·2	65·2	43·4	21·8	52·7	42·8	·271	3·1	1·3	68	542	110·8	39·0	—	16	7	3	5	—	5·8	5	0·26
		June	29·780	0·636	79·8	38·3	41·5	69·1	50·1	19·0	57·5	50·2	·364	4·1	1·2	77	533	113·4	46·1	—	16	4	3	7	—	7·0	17	4·04
OXFORD (The Observatory), E. J. STONE, ESQ., M.A., F.R.S.	210	April	29·654	1·162	63·8	31·4	32·4	54·0	40·4	13·6	46·6	40·2	·250	2·9	0·7	79	542	99·0	37·6	1·3	9	5	8	8	2·8	7·1	19	1·90
		May	29·866	0·762	72·5	35·3	37·2	60·6	43·3	17·3	51·5	43·8	·287	3·2	1·1	75	541	113·5	39·9	1·2	12	8	4	7	2·9	6·6	6	0·83
		June	29·688	0·680	71·2	40·9	30·3	64·3	50·4	13·9	56·8	51·0	·375	4·1	1·0	81	532	113·8	47·6	1·6	9	4	7	10	2·0	7·6	18	3·37
ROYSTON (Hertfordshire), HALE WORTHAM, ESQ., F.R.A.S., F.M.S.	269	April	29·607	1·152	67·8	31·5	36·3	56·6	37·8	18·8	45·7	40·7	·255	2·9	0·5	83	543	—	—	—	8	5	8	9	—	6·6	15	1·71
		May	29·833	0·729	84·1	29·3	54·8	63·1	40·0	23·1	50·3	43·5	·283	3·3	0·8	78	542	—	—	—	15	6	3	7	—	6·2	8	0·64
		June	29·653	0·685	78·0	34·4	43·6	67·2	46·8	20·4	55·0	51·8	·386	4·3	0·6	89	533	—	—	—	9	5	6	10	—	7·7	13	3·48
BEDFORD, Cardington, MR. J. MCLAREN, Assistant to S. C. WHITBREAD, ESQ., M.P.	105	April	29·727	1·164	68·4	33·0	35·4	56·2	39·3	16·9	46·0	43·2	·280	3·2	0·4	91	544	86·6	33·6	1·5	7	8	4	11	—	7·0	9	1·54
		May	29·952	0·740	81·0	29·0	52·0	62·2	41·8	20·4	51·0	44·1	·290	3·3	0·9	78	543	105·6	35·4	1·3	10	12	1	8	—	6·0	6	2·20
		June	29·766	0·686	75·6	34·6	41·0	67·5	48·5	19·0	56·5	52·3	·393	4·4	0·7	86	533	107·2	45·1	1·2	7	8	3	12	—	7·3	14	2·45
CAMBRIDGE (Trinity College), J. W. L. GLAISHER, ESQ., M.A., F.R.S.	40	April	29·801	1·178	70·0	30·0	40·0	57·9	39·4	18·5	47·0	41·5	·262	3·0	0·7	82	545	117·8	34·3	1·6	8	7	8	7	—	6·4	16	1·73
		May	30·022	0·752	85·0	29·3	55·7	65·0	41·1	23·9	51·6	44·4	·292	3·3	1·1	76	544	132·8	34·7	1·3	10	11	5	5	—	5·6	9	0·68
		June	29·832	0·672	79·3	38·0	41·3	69·6	48·5	21·1	56·9	52·3	·392	4·4	0·8	88	534	134·8	42·7	1·0	8	8	7	7	—	7·2	17	2·65
RUGBY (Warwickshire), Stockton, "The Rectory," W. TUCKWELL, ESQ.	280	April	29·341	1·148	64·5	30·0	34·5	54·7	37·3	17·4	45·7	38·8	·237	2·7	0·8	77	541	64·2	33·7	6·4	7	8	10	5	6·9	6·8	15	1·57
		May	29·763	0·700	71·5	27·5	44·0	61·0	39·3	21·7	49·2	42·6	·274	3·1	0·9	78	541	74·6	36·2	0·4	10	10	4	7	5·5	5·2	11	1·04
		June	29·593	0·658	75·0	34·0	41·0	66·9	47·2	19·7	55·7	51·0	·376	4·2	0·8	85	531	79·7	44·3	0·4	6	7	8	9	3·8	6·5	19	1·56
LOWESTOFT (Suffolk), S. H. MILLER, ESQ., F.R.A.S., F.M.S.	85	April	29·776	1·158	61·8	35·0	26·8	53·0	40·0	13·0	46·0	40·2	·250	2·9	0·7	81	545	100·1	38·1	0·9	7	8	6	9	—	6·0	13	1·74
		May	29·972	0·768	75·5	34·8	40·7	57·0	43·2	13·8	49·2	43·0	·278	3·1	0·9	79	545	110·9	40·1	0·8	11	11	3	6	—	6·8	10	0·52
		June	29·788	0·604	75·8	39·0	36·8	62·3	49·4	12·9	54·6	49·9	·358	4·0	0·8	84	536	114·0	46·3	0·7	8	8	4	10	—	6·3	17	2·10

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean Of all Highest.	Temperature of Air in Month. Mean Of all Lowest.	Temperature of Air in Month. Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
SOMERLEYTON (Suffolk), The Rectory, REV. C. J. STEWARD, F.M.S.	50	April	29·811	1·204	61·5	34·0	27·5	52·8	40·4	12·4	45·6	43·5	·283	3·2	0·3	93	546	—	—	1·2	9	7	6	8	7·7	6·3	14	1·76
		May	30·019	0·766	79·7	33·2	46·5	56·7	42·9	13·8	48·7	45·1	·301	3·4	0·5	88	547	—	—	1·2	12	10	2	7	7·9	5·1	9	0·62
		June	29·840	0·672	75·4	39·8	35·6	62·8	48·8	14·0	54·3	50·5	·368	4·2	0·6	87	537	—	—	1·0	7	10	5	8	7·3	6·4	17	2·91
WOLVERHAMPTON (Staffordshire), Wrottesley, E. SIMPSON, ESQ.	500	April	29·290	1·212	59·3	29·5	29·8	52·2	37·7	14·5	43·9	37·4	·223	2·6	0·7	77	539	—	—	—	6	8	9	7	—	7·6	12	1·44
		May	29·862	0·702	67·5	34·4	33·1	59·5	40·6	18·9	48·2	40·0	·247	2·8	1·0	74	539	—	—	—	7	13	5	6	—	6·8	8	2·29
		June	29·546	0·758	73·4	35·8	37·6	63·4	47·3	16·1	53·8	47·3	·325	3·7	1·0	78	529	—	—	—	6	7	6	11	—	7·7	16	3·17
NORWICH (Norfolk), The Literary Institution, JOHN QUINTON, ESQ., JUN.	42	April	29·820	1·196	67·0	37·0	30·0	54·9	42·1	12·8	47·3	40·5	·252	2·9	0·8	78	545	—	—	—	9	5	7	9	—	—	15	1·35
		May	31·027	0·776	81·0	37·0	44·0	59·3	44·6	14·7	50·6	41·4	·261	3·0	1·0	71	545	—	—	—	13	7	4	7	—	—	6	0·40
		June	29·839	0·712	77·0	41·0	36·0	65·1	51·1	14·0	56·5	50·0	·360	4·0	0·9	79	535	—	—	—	8	9	4	9	—	—	14	2·88
LEICESTER (Town Museum), W. J. HARRISON, ESQ., F.G.S.	238	April	29·589	1·228	64·2	32·5	31·7	53·7	39·9	13·8	46·0	38·9	·238	2·7	0·9	77	542	98·5	30·5	0·8	7	7	7	9	—	6·7	22	2·21
		May	29·826	0·722	69·2	32·1	37·1	59·0	42·1	16·9	50·3	39·4	·241	2·8	1·4	66	542	110·7	33·2	0·6	9	9	7	6	—	7·4	14	1·48
		June	29·635	0·754	73·0	38·0	35·0	64·4	48·7	15·7	55·7	48·3	·343	3·8	1·2	79	532	116·2	41·3	0·7	8	6	7	9	—	7·5	22	3·85
NOTTINGHAM (Notts), M. O. TARBOTTON, ESQ., C.E., F.G.S., F.M.S.	183	April	29·639	1·252	65·7	32·7	33·0	56·1	38·9	17·2	46·1	38·6	·235	2·7	0·9	76	543	90·7	37·2	0·5	5	8	9	8	2·4	6·8	16	2·21
		May	29·884	0·750	77·6	31·0	44·6	62·8	41·2	21·6	50·2	41·6	·263	3·0	1·1	73	543	106·0	39·5	0·3	9	12	5	5	1·7	5·5	10	1·35
		June	29·691	0·780	84·0	35·5	48·5	68·9	48·0	20·9	56·1	50·9	·374	4·2	0·8	83	532	108·4	47·7	0·3	7	10	8	5	1·6	7·3	22	6·30
HOLKHAM (Norfolk), JOHN DAVIDSON, ESQ., Assistant to the EARL of LEICESTER.	39	Jan.	30·289	1·204	55·7	12·2	43·5	38·4	24·9	13·5	33·2	27·6	·151	1·8	0·4	79	570	52·1	20·7	1·0	5	2	18	6	—	6·1	1	0·16
		Feb.	29·692	1·564	53·6	19·6	34·0	47·3	32·6	14·7	41·3	38·3	·232	2·7	0·4	90	549	77·2	26·7	1·8	2	1	20	6	—	6·6	10	1·23
		Mar.	30·038	1·438	56·6	22·0	34·6	48·5	32·5	16·0	41·0	35·8	·209	2·4	0·6	82	556	90·0	26·7	1·5	6	14	8	3	—	6·6	6	1·04
		April	29·790	1·251	67·0	28·4	38·6	54·0	38·3	15·7	45·1	40·6	·252	2·9	0·5	84	547	101·4	31·6	1·8	8	6	13	3	—	7·0	16	1·80
		May	30·014	0·764	75·4	24·5	48·9	57·9	40·5	17·4	48·1	43·7	·284	3·3	0·5	85	547	123·5	34·5	1·5	13	5	5	8	—	5·6	12	0·87
		June	29·836	0·686	73·7	34·8	38·9	63·4	45·9	17·5	54·4	48·5	·340	3·9	0·9	80	537	124·1	40·9	1·5	11	5	9	5	—	7·0	16	2·75
LLANDUDNO (Carnarvonshire), JAMES NICOL, ESQ., M.D., and THOMAS DALTON, ESQ., M.D.	100	Apr.	29·729	1·310	59·8	34·0	25·8	52·0	42·4	9·6	46·7	39·7	·245	2·9	0·8	78	544	—	—	1·2	8	10	5	12	—	6·2	12	1·24
		May	30·004	0·800	62·8	36·4	26·4	56·1	44·9	11·2	50·0	43·8	·286	3·3	0·8	80	545	—	—	1·1	8	15	4	9	—	4·7	8	1·78
		June	29·817	0·770	68·7	41·0	27·7	61·7	51·1	10·6	55·4	48·7	·345	3·9	1·1	79	535	—	—	0·8	8	8	4	10	—	6·8	16	2·59
KELSTERN GRANGE, near Louth (Lincolnshire), D. GRANT BRIGGS, ESQ., F.M.S.	393	April	29·437	1·296	64·3	30·2	34·1	52·0	38·2	13·8	44·2	39·2	·259	2·8	0·6	82	541	99·5	34·8	1·3	7	7	7	9	8·2	6·2	16	2·47
		May	29·678	0·791	69·6	32·2	37·4	55·8	40·4	15·4	47·1	41·6	·263	3·0	0·7	82	542	107·5	37·9	1·1	12	8	4	7	8·6	6·9	11	1·20
		June	29·490	0·765	72·5	36·8	35·7	61·7	47·6	14·1	53·2	48·6	·343	3·9	0·7	81	532	112·6	45·1	0·9	9	8	5	8	8·1	7·5	19	4·28
LIVERPOOL, The Observatory, JOHN HARTNUP, ESQ., F.R.A.S.	197	April	29·624	1·269	62·0	36·9	25·1	52·4	41·5	10·9	45·6	39·6	·244	2·8	0·7	80	543	—	—	1·4	7	8	6	9	—	6·4	12	1·27
		May	29·884	0·714	64·0	38·9	25·1	57·0	44·6	12·4	49·6	42·2	·269	3·0	0·8	75	543	—	—	1·3	8	8	3	12	—	5·5	7	2·08
		June	29·697	0·777	72·1	42·0	30·1	62·5	51·2	11·3	55·2	50·9	·373	4·2	0·7	86	533	—	—	1·2	7	7	5	11	—	7·1	20	2·48
BOLTON, Sharples (Lancashire), REV. T. MACKERETH, F.R.A.S., F.M.S.	481	April	29·305	1·278	58·8	31·0	27·8	51·3	37·1	14·2	43·5	36·5	·216	2·5	0·7	76	540	68·9	32·1	2·6	5	8	10	7	5·7	7·1	19	2·25
		May	29·561	0·736	65·7	29·9	35·8	57·7	38·3	19·4	47·3	40·0	·247	2·9	0·9	77	540	74·7	32·6	1·6	10	7	3	11	5·6	4·9	9	3·05
		June	29·375	0·786	74·0	36·8	37·2	62·8	47·3	15·5	54·0	48·4	·340	3·9	0·8	81	529	76·6	40·0	1·6	8	6	6	10	5·8	7·5	21	3·90
HALIFAX, Bermerside Observatory (Yorkshire), E. J. CROSSLEY, ESQ., F.R.A.S.	530	Apr.	29·402	1·260	65·2	30·0	35·2	53·3	37·7	15·6	43·8	38·1	·230	2·7	0·6	80	541	90·9	35·6	0·7	6	7	8	9	—	7·1	20	2·63
		May	29·589	0·760	72·5	28·9	43·6	58·0	40·4	17·6	47·5	40·1	·248	2·9	0·9	76	540	97·7	35·7	0·6	7	10	5	9	—	6·5	9	2·79
		June	29·364	0·818	75·7	—	—	63·9	—	—	51·3	47·7	·332	3·7	0·5	87	532	105·9	44·7	0·6	5	10	7	8	—	7·9	19	3·61
HULL (Yorkshire), The People's Park, MR. E. PEAKE.	12	April	29·838	1·320	66·0	30·0	36·0	54·6	38·0	16·6	46·3	37·5	·226	2·6	1·0	72	545	81·8	35·8	2·0	7	5	9	9	2·0	8·0	16	1·77
		May	30·081	0·840	69·0	32·0	37·0	58·1	40·6	17·5	48·9	40·7	·256	2·9	1·1	74	548	85·6	38·2	2·1	10	8	3	10	1·7	7·1	12	1·65
		June	29·895	0·808	77·0	38·0	39·0	64·5	48·3	16·5	55·5	49·6	·357	4·0	0·9	82	537	89·7	46·3	2·5	8	10	6	6	2·7	7·0	19	2·41
STONYHURST (Lancashire), REV. S. J. PERRY, F.R.S., F.M.S., F.R.A.S.	363	April	29·450	1·292	60·3	31·0	29·3	54·2	37·4	16·8	44·5	38·7	·233	2·7	0·7	79	541	106·7	36·2	—	6	7	8	9	—	6·5	18	2·02
		May	29·714	0·786	69·4	32·0	37·4	59·5	40·6	18·9	48·2	41·5	·261	3·0	0·8	78	542	117·1	39·2	—	7	8	5	11	—	6·0	10	2·84
		June	29·525	0·798	73·6	36·4	37·2	64·9	48·0	16·9	55·0	48·5	·342	3·8	1·1	79	531	118·1	48·3	—	4	9	4	15	—	8·0	18	4·79

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean Of all Highest.	Temperature of Air in Month. Mean Of all Lowest.	Temperature of Air in Month. Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
BRADFORD (Yorkshire), J. McLandsborough, Esq., C.E., F.G.S.	366	April	29·440	1·302	60·3	32·0	28·3	52·6	40·4	12·2	45·2	37·9	·228	2·6	0·8	76	540	72·5	–	1·5	7	7	7	9	–	6·5	22	1·82
		May	29·676	0·770	67·0	34·6	32·4	58·1	43·1	15·0	48·8	40·7	·255	2·9	1·1	74	541	80·8	–	1·3	8	9	5	9	–	6·5	14	2·49
		June	29·513	0·808	71·4	39·0	32·4	63·2	50·1	13·1	54·5	47·8	·331	3·8	1·0	78	531	80·4	–	1·0	7	10	7	6	–	7·0	23	1·92
LEEDS (Yorkshire), The Philosophical Hall, H. Crowther, Esq.	137	April	29·699	1·406	63·0	34·0	29·0	55·5	39·9	15·6	46·3	40·3	·251	2·9	0·7	81	544	68·7	–	2·2	6	8	4	12	–	3·7	13	2·23
		May	29·967	0·936	72·0	35·0	37·0	60·3	42·3	18·0	50·5	39·9	·247	2·8	1·3	70	544	79·2	–	2·0	8	12	2	9	–	3·0	7	2·05
		June	29·759	0·744	76·0	38·0	38·0	64·2	48·9	15·3	54·0	51·6	·382	4·3	0·4	91	536	76·2	–	1·8	5	8	3	14	–	3·8	16	2·41
COCKERMOUTH (Cumberland), H. Dodgson, Esq., M.D., F.M.S., F.R.A.S.	146	April	29·667	1·349	60·1	28·8	31·3	53·8	39·6	14·2	45·6	38·9	·238	2·7	0·8	78	544	104·4	32·6	0·5	2	10	7	11	3·4	6·6	19	3·13
		May	29·934	0·844	66·3	32·3	34·0	59·2	41·9	17·3	49·5	41·0	·258	2·9	1·1	73	545	108·1	35·5	0·5	6	12	3	10	2·0	5·5	6	1·64
		June	29·748	0·808	76·5	34·4	42·1	65·1	48·2	16·9	55·5	47·3	·328	3·7	1·2	74	534	112·9	43·3	0·4	7	9	7	7	2·2	6·6	16	2·64
SILLOTH (Cumberland), "The Rectory," Rev. F. Redford, M.A., F.R.A.S., F.M.S.	28	April	29·799	1·365	60·7	30·5	30·2	53·8	39·6	14·2	45·3	39·9	·247	2·8	0·6	82	547	99·8	33·8	1·5	3	8	6	13	9·2	5·4	13	2·06
		May	30·063	0·831	72·5	32·2	40·3	58·7	42·3	16·4	49·3	41·0	·258	2·9	1·1	73	547	109·5	36·4	1·3	5	11	4	11	7·9	5·7	12	1·21
		June	29·825	0·842	71·8	36·8	35·0	65·5	44·3	21·2	53·8	49·1	·347	3·9	0·7	84	537	114·7	39·2	1·1	4	10	5	11	7·4	6·0	16	2·33
CARLISLE, Spital (Cumberland), Isaac Cartmel, Esq., F.M.S.	114	April	29·699	1·391	62·3	26·7	35·6	54·6	37·5	17·1	45·0	38·5	·233	2·7	0·7	78	545	91·5	31·1	1·4	3	11	4	12	5·3	5·4	22	2·32
		May	29·968	0·886	70·8	27·5	43·3	59·4	40·5	18·9	49·0	40·7	·255	2·9	1·1	73	546	98·2	33·9	1·4	3	15	3	10	4·0	5·7	10	1·30
		June	29·759	1·136	76·5	34·5	42·0	66·5	47·1	19·4	55·5	48·6	·344	3·8	1·1	78	534	106·9	41·7	1·4	6	10	2	12	3·3	7·0	15	2·18
BYWELL (Northumberland), Mr. W. J. Tone, Assistant to W. B. Beaumont, Esq., M.P.	87	April	–	1·368	61·0	31·0	30·0	52·0	39·6	12·4	44·7	42·6	·273	3·1	0·2	93	533	59·2	30·7	1·2	9	9	5	7	–	7·6	18	2·10
		May	–	1·110	67·0	27·0	40·0	58·4	42·4	16·0	49·4	43·8	·287	3·3	0·7	83	535	69·4	30·1	1·1	6	11	2	12	–	7·2	11	1·83
		June	–	0·882	73·0	41·0	32·0	64·5	51·4	13·1	55·9	51·0	·377	4·2	0·8	85	535	71·3	42·2	1·1	7	10	3	10	–	7·6	15	1·71
NORTH SHIELDS (Northumberland), Robert Spence, Esq.	124	April	29·753	1·366	59·0	32·0	27·0	51·1	39·5	11·6	44·0	39·6	·244	2·8	0·5	84	547	–	39·1	1·7	9	7	5	9	–	6·4	17	1·74
		May	30·042	0·919	65·0	34·7	30·3	54·5	42·6	11·9	47·4	41·4	·262	3·0	0·7	81	549	–	41·8	1·4	11	10	3	7	–	5·3	13	1·32
		June	29·850	0·797	67·3	39·0	28·3	58·9	48·6	10·3	52·4	48·2	·336	3·8	0·7	85	539	–	48·3	1·5	12	10	2	6	–	6·5	13	1·24

Second Rain-gauges are placed—

		April		May.		June.		Total in Quarter.
At Beachy Head, at the height of 515 feet *above the sea*, the amount collected was		1·52 inches.	-	0·00 inches.	-	1·88 inches.	-	3·40 inches.
,, ,, ,, 495 ,, ,, ,,		1·65 ,,	-	0·00 ,,	-	2·05 ,,	-	3·70 ,,
,, Strathfield Turgiss, ,, 38 ,, *ground* ,,		1·21 ,,	-	0·43 ,,	-	1·95 ,,	-	3·59 ,,
,, Oxford, ,, 22 ,, ,, ,,		2·48 ,,	-	0·81 ,,	-	3·69 ,,	-	6·98 ,,
,, Cardington, ,, 36 ,, ,, ,,		1·26 ,,	-	2·00 ,,	-	2·15 ,,	-	5·41 ,,
,, Nottingham, ,, 39 ,, ,, ,,		1·93 ,,	-	1·34 ,,	-	6·17 ,,	-	9·44 ,,

Note.—*Barometer Reading*, Lowestoft, April 5th, at 3h. p.m., 30·288 inches, has been altered to 29·288 inches.
,, ,, ,, 6th, at 3h. p.m., 30·292 ,, ,, 29·292 ,,
,, Bywell, ,, 14th, at 3h. p.m., 29·998 ,, ,, 28·998 ,,
,, Barnstaple, June 7th, at 3h. p.m., 30·90 ,, ,, 29·90 ,,

Fog prevailed on the 3rd and 4th of April at Guernsey; on the 8th at Royston, Cambridge, and Kelstern; on the 12th at Llandudno; on the 13th at Bath, Bolton, Hull, and North Shields; on the 14th at Guernsey, Bath, Wolverhampton, Hull, and Stonyhurst; on the 15th at Llandudno; and on the 23rd at Bath. On the 2nd of May at Bath and Kelstern; on the 3rd at Royston, Cardington, Stockton, and Cambridge; on the 10th at Stockton; on the 11th at Strathfield; on the 12th and at Bath; and on the 19th at Kelstern. On the 10th of June at Hull, on the 11th at Bath, Cambridge, and North Shields; on the 12th at Oxford, Royston, Stockton, and Cambridge; on the 14th at Guernsey, Torquay, and Strathfield; on the 15th at Llandudno; on the 16th at Torquay, Bath, and Llandudno; on the 17th at Guernsey, Torquay, and Cambridge; on the 18th at Guernsey, Torquay, and North Shields; on the 19th at Torquay and Llandudno; on the 20th at Torquay, Llandudno, and North Shields; on the 21st at Carlisle and North Shields; on the 22nd at North Shields, and on the 23rd at Bath and Cambridge.

NAMES OF STATIONS.	Mean Pressure of dry Air reduced to the level of the Sea.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°							
Guernsey - - -	29·644	76·5	38·5	38·0	59·2	47·5	28·0	11·7	51·6	46·3	·316	3·6	0·8	83	538	101·5	44·9	1·4	10	8	5	7	1·9	4
Truro - - -	29·655	71·0	31·0	40·0	61·1	45·6	34·0	15·5	50·3	45·9	·311	3·6	0·7	83	542	—	—	2·4	9	7	7	7	—	6
Plymouth - - -	29·725	76·3	36·4	39·9	60·3	47·1	31·4	13·2	52·6	45·8	·311	3·5	0·9	78	541	—	—	1·7	10	7	6	8	—	6
Torquay - - -	29·680	75·1	34·3	40·8	59·2	45·4	33·4	13·8	51·2	44·7	·299	3·4	0·9	78	537	131·1	38·8	1·4	9	8	6	8	4·9	6
Eastbourne - - -	29·658	77·0	34·7	42·3	62·4	45·2	36·1	17·2	52·8	47·5	·336	3·7	0·8	83	540	115·2	34·9	0·8	7	8	4	11	2·2	—
Ventnor - - -	29·661	73·6	37·0	36·6	59·5	46·6	27·9	12·9	51·7	46·9	·326	3·7	0·7	84	541	—	—	—	6	10	6	8	5·1	5
Osborne - - -	29·601	79·0	32·7	46·3	63·2	44·7	38·1	18·5	52·6	49·2	·354	4·0	0·5	88	538	115·2	41·5	1·4	7	8	8	8	—	6
Bournemouth - -	29·703	75·1	32·1	43·0	59·0	44·7	32·6	14·3	51·0	43·6	·288	3·3	1·0	77	538	—	—	1·6	8	8	7	7	—	5
Brighton - - -	29·683	74·6	36·0	38·6	60·5	45·2	32·5	15·3	52·1	43·8	·290	3·3	1·2	73	539	102·7	42·1	0·8	8	6	9	7	—	7
Barnstaple - - -	29·648	75·0	36·0	39·0	62·5	48·8	33·0	13·7	53·9	45·9	·314	3·5	1·2	75	539	—	—	1·2	8	6	8	8	—	4
Ramsgate - - -	29·625	80·0	37·4	42·6	59·5	45·3	32·2	14·2	51·4	48·3	·342	3·9	0·5	90	540	107·6	—	1·2	5	10	7	7	—	6
Strathfield Turgiss -	29·675	78·5	29·1	49·4	62·3	42·7	40·5	19·6	51·5	44·0	·292	3·3	0·9	76	539	111·7	37·3	1·3	8	8	4	10	2·3	6
Bath - - -	29·685	74·0	31·0	43·0	58·2	42·9	32·6	15·3	49·3	43·8	·289	3·3	0·7	82	533	108·2	39·9	1·3	8	7	7	8	—	6
Marlborough - -	29·677	74·9	31·2	43·7	60·2	42·8	36·9	17·4	50·5	43·9	·287	3·3	1·0	77	535	113·0	36·4	—	7	8	5	10	—	6
Blackheath - -	29·652	87·2	31·9	55·3	62·4	43·1	43·8	19·3	51·4	45·2	·305	3·5	0·9	80	540	117·9	39·1	1·0	6	11	5	9	—	6
Camden Square -	29·669	85·0	33·8	51·2	63·8	44·8	41·9	19·0	52·6	44·1	·294	3·3	1·2	73	539	108·2	40·6	—	14	5	4	7	—	6
Oxford - - -	29·661	72·5	31·4	41·1	59·6	44·7	33·8	14·9	51·6	45·0	·304	3·4	0·9	78	538	108·8	41·7	1·4	10	6	6	8	2·6	7
Royston - - -	29·686	84·1	29·3	54·8	62·3	41·5	44·9	20·8	50·3	45·3	·308	3·5	0·6	83	539	—	—	—	10	5	6	9	—	6
Cardington - - -	29·604	81·0	29·0	52·0	62·0	43·2	42·8	18·8	51·2	46·5	·321	3·6	0·7	85	540	99·8	38·0	1·3	8	9	3	10	—	6
Cambridge - - -	29·614	85·0	29·3	55·7	64·2	43·0	45·7	21·2	51·8	46·1	·315	3·6	0·9	82	541	128·5	37·2	1·3	9	9	7	6	—	6
Rugby - - -	—	75·0	27·5	47·5	60·9	41·3	39·9	19·6	50·2	44·1	·296	3·3	0·8	80	538	72·8	37·7	0·4	8	8	7	7	5·4	6
Lowestoft - - -	29·643	75·8	34·8	41·0	57·4	44·2	34·8	13·2	49·9	44·4	·295	3·3	0·8	81	542	108·3	41·5	0·8	9	9	4	9	—	6
Somerleyton - -	29·629	79·7	33·2	46·5	57·4	44·0	36·5	13·4	49·5	46·4	·317	4·6	0·5	89	543	—	—	1·1	9	9	4	8	7·6	5
Wolverhampton -	29·684	73·4	29·5	43·9	58·4	41·9	33·5	16·5	48·6	41·6	·265	3·0	0·9	76	536	—	—	—	6	9	7	8	—	7
Norwich - - -	29·646	81·0	37·0	44·0	59·8	45·9	36·7	13·8	51·5	44·0	·291	3·3	0·9	76	542	—	—	—	10	7	5	9	—	—
Leicester - - -	29·678	73·0	32·1	40·9	59·0	43·6	34·6	15·5	50·7	42·2	·274	3·1	1·2	74	539	108·5	35·0	0·7	8	7	7	8	—	7
Nottingham - -	29·648	84·0	31·0	53·0	62·6	42·7	42·7	19·9	50·8	43·7	·291	3·3	0·9	77	539	101·7	41·5	0·4	7	10	7	6	1·2	6
Holkham - - -	29·632	75·4	26·5	48·9	58·4	41·6	42·1	16·8	49·2	44·3	·292	3·4	0·6	83	544	116·3	35·7	1·6	11	5	9	5	—	6
Llandudno - - -	29·668	68·7	34·0	34·7	56·6	46·1	26·6	10·5	50·7	44·1	·292	3·4	0·9	79	541	—	—	1·0	5	11	4	10	—	5
Kelstern Grange -	29·683	72·5	30·2	42·3	56·5	42·1	35·7	14·4	48·2	43·1	·282	3·2	0·7	83	538	106·5	39·3	1·1	9	8	5	8	8·3	6
Liverpool - - -	29·657	72·1	36·9	35·2	57·3	45·8	26·8	11·5	50·1	44·2	·295	3·3	0·7	80	540	—	—	1·3	7	8	5	11	—	6
Bolton - - -	29·683	74·0	29·9	44·1	57·3	40·9	33·6	16·4	48·3	41·6	·268	3·1	0·8	78	536	73·4	34·9	1·9	8	7	6	9	5·7	6
Halifax - - -	—	75·7	28·9	46·8	58·4	—	—	—	47·5	42·0	·270	3·1	0·7	81	538	98·2	38·7	0·6	6	9	7	9	—	7
Hull - - -	29·671	77·0	30·0	47·0	59·2	42·8	37·3	16·9	50·2	42·6	·280	3·2	1·0	76	544	85·7	40·1	2·2	8	8	6	8	2·1	7
Stonyhurst - - -	29·683	73·6	31·0	42·6	59·5	42·0	34·6	17·5	49·2	42·6	·279	3·2	0·9	79	538	114·0	41·2	—	6	8	6	11	—	6
Bradford - - -	29·675	71·4	32·0	39·4	58·0	44·5	31·0	13·5	49·5	42·1	·271	3·1	1·0	76	537	77·9	—	1·3	7	9	6	8	—	6
Leeds - - -	29·666	76·0	34·0	42·0	60·0	43·7	34·7	16·3	50·3	43·9	·293	3·3	0·8	81	541	74·7	—	2·0	6	9	3	12	—	7
Cockermouth - -	29·670	76·5	28·8	47·7	59·4	43·2	35·8	16·2	50·2	42·4	·275	3·1	1·0	75	541	108·5	37·1	0·5	5	10	6	9	2·5	6
Silloth - - -	29·643	74·5	30·5	42·0	59·3	42·1	35·2	17·2	49·5	43·3	·284	3·2	0·8	80	544	108·0	36·5	1·3	4	10	5	12	8·2	5
Carlisle - - -	29·657	76·5	26·7	49·8	60·2	41·7	40·3	18·5	49·8	42·6	·277	3·1	1·0	76	542	97·9	35·6	1·4	4	12	3	11	4·2	6
Bywell - - -	—	73·0	27·0	46·0	58·3	44·5	34·0	13·8	50·0	45·8	·312	3·5	0·6	87	534	76·6	34·3	1·2	7	10	3	10	—	7
North Shields - -	—	67·3	32·0	35·3	54·8	43·6	28·5	11·2	47·9	43·1	·281	3·2	0·6	83	545	—	43·1	1·5	11	9	3	7	—	6

The highest temperatures of the air were at Blackheath, 87°·2; Camden Square and Cambridge, both 85°·0; Royston, 8 Nottingham, 84°·0.

The lowest temperatures of the air were at Holkham, 26°·5; Carlisle, 26°·7; Bywell, 27°·0 Rugby, 27°·5; and Cockermouth,

The greatest daily ranges of the temperatures of the air were at Cambridge, 21°·2; Royston 20°·8; Nottingham, 19°·9; and Turgiss and Rugby, both 19°·6.

The least daily ranges of the temperatures of the air were at Llandudno, 10°·5; North Shields, 11°·2, Liverpool, 11°·5; an 11°·7.

The greatest number of rainy days were at Bradford, 59; Leicester, 58; Bolton, 49; and Nottingham and Halifax, both 48.

The least number of rainy days were at Cardington, 29; Ramsgate 30; Plymouth, Osborne, and Brighton, all 33.

The heaviest falls of rain were at Nottingham, 9·86 inches; Stonyhurst, 9·65 inches; Bolton, 9·28 inches; and Halifax 9·0

The least falls of rain were at Brighton, 3·32 inches; Norwich, 4·13 inches; Rugby, 4·17 inches; North Shields, 4·30 Lowestoft, 4·36 inches.

QUARTERLY METEOROLOGICAL TABLE for different PARALLELS of LATITUDE.

PARALLELS OF LATITUDE, &c.	Mean Pressure of dry Air reduced to the level of the Sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	Wind. Mean Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°						
Guernsey - - - -	29·644	76·5	38·5	38·0	59·2	47·5	28·0	11·7	51·6	46·3	·316	3·6	0·8	83	538	101·5	44·9	1·4	10	8	5	7	1·9
Between the latitudes 50° and 51° -	29·667	74·9	34·6	40·3	60·6	45·8	32·9	14·8	51·9	46·1	·315	3·6	0·8	81	540	116·3	40·5	1·5	8	7	7	8	5·0
Between the latitudes 51° and 52° -	29·662	78·4	32·7	45·7	61·1	44·4	36·8	16·7	51·5	45·0	·303	3·4	0·9	79	538	110·8	39·2	1·2	8	8	6	8	2·5
Between the latitudes 52° and 53° -	29·647	78·6	30·2	48·4	60·3	42·7	39·8	17·6	50·2	44·5	·297	3·5	0·8	81	540	105·1	38·1	0·9	8	8	6	8	5·0
Between the latitudes 53° and 54° -	29·673	73·4	31·9	41·5	58·1	43·4	32·5	14·7	49·3	42·9	·281	3·2	0·8	79	539	90·1	38·8	1·4	7	8	5	10	5·4
Between the latitudes 54° and 55° -	29·657	74·6	28·2	46·4	59·3	42·9	36·3	16·4	49·9	43·5	·287	3·2	0·9	79	540	97·8	35·9	1·1	5	10	4	11	5·0
Mean for the Quarter, 50° to 55° Year 1877	29·586	81·1	29·0	52·1	59·8	44·9	35·1	15·9	50·5	43·6	·289	3·3	1·0	78	539	98·7	38·8	1·3	7	9	8	7	4·6
" 1878	29·510	86·8	28·0	58·8	62·6	46·1	39·2	16·5	52·9	46·9	·325	3·7	0·9	81	536	104·8	41·6	1·1	5	9	9	8	4·3
" 1879	29·542	70·7	27·1	43·6	57·0	42·1	32·9	14·9	48·2	42·9	·282	3·2	0·7	82	540	96·2	37·7	1·1	7	7	8	9	5·0
" 1880	29·661	76·0	31·5	44·5	59·9	43·8	35·7	16·1	50·6	44·4	·297	3·5	0·8	80	539	104·0	38·5	1·2	7	8	6	9	4·6

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING SEPTEMBER 30, 1880.

REMARKS ON THE WEATHER DURING THE QUARTER ENDING SEPTEMBER 30TH, 1880.

By JAMES GLAISHER, ESQ., F.R.S., *&c.*

THE weather in July was dull, unsettled, and wet in all parts of the country, in some places rain fell on 26 or 27 days in the month, and at all places, excepting at the extreme south of England, the number of days of rain exceeded 20. Thunder storms were of frequent occurrence. During the most remarkable storm in the month, viz., that of the 14th–16th, the fall of rain at Cardington between 14th, 1 h. p.m., and 15th, 9 h. a.m., or in 20 hours was 2·37 inches. At Stockton, near Rugby on the 13th, the fall was still heavier; the Observer says:—" The rain " fell in torrents from 4·30 till 6 p.m., with violent hail, which lay thick on the ground. The " rain gauge read 1·72 inch at 6 p.m., but the hail choking the tube probably made the register " inadequate. The thunder and lightning were almost continuous during two hours. The storm " began again at 3 h. a.m. on the 14th, the rain being not less heavy, but with no hail and little " thunder. The first fall was preceded by an unusual current of air, which lowered the " temperature from between 70° and 80° to 37°. There was scarcely any ozone." The fall on the 13th was 3·57 inches, and on the 14th was 1·12 or 4·69 inches in two days.

Wheat crops were laid in many places, and at the end of the month water stood on the land in low lying districts, and rivers were full. The month was most unfavourable for harvest work. The fall of rain exceeded its average at all places, and by as much as 3 or 4 inches in some localities.

The weather at the beginning of August was cold, with frequent rain; on the 8th a favourable change took place, on the 9th the weather was fine in all districts, and from this time to the end of the month the weather was genial and fine, there was scarcely any rain, but there was an absence of bright sunshine, the wind was mostly from the N.E., and corn did not harden so quickly as desirable, but still very great progress was made in all harvest work. On the whole the month was remarkably fine.

In September very fine weather was prevalent during the first week, and the highest temperature in the year at by far the greatest number of places was recorded on the 4th of September. Rain then set in, and from the 6th to the 21st fell on nearly every day. The heaviest falls were in the eight days ending the 18th; more than one inch on one day occurred at many places, as follows:—

On 11th at Ventnor the fall was 1·22 in., Osborne 1·46 in., Brighton 1·16 in., Strathfield 1·61 in., London 1·33 in., Royston 1·62 in., Cardington 1·59 in., Cambridge 1·25 in., Blackheath 1·13 in., Kelstern 1·55 in., and Hull 1·42 in. On September 12th at Brighton 1·01 in., Marlborough 1·01 in., Oxford 1·12 in., Whitchurch 1·12 in., Stockton 1·26 in., Leicester 1·22 in., and Bolton 1·05 in. On September 13th, at Cockermouth 0·99 in., and at Nottingham 1·07 in. On September 14th at London 1·18 in., Lowestoft 1·07 in., Somerleyton 1·38 in., Kelstern 1·87 in., Hull 1·42 in., Carlisle 1·00 in., Bywell 1·22 in., and North Shields 1·02 in. On September 15th at Barnstaple 0·98 in., Cardington 1·74 in., Leicester 1·39 in., Birmingham 1·55 in., and Sheffield 1·18 in. On September 18th, at Bolton 1·17 in.

The fall of rain in the 8 days ending September 18th, was the heaviest generally; at Leicester the fall was 5·07 ins., Birmingham 4·45 ins., Leeds 4·43 ins., Sheffield 4·32 ins., Hull 4·19 ins., Brighton 3·99 ins., Nottingham 3·64 ins., causing destructive floods at many places, particularly at Sheffield and at Leicester.

No rain fell during the last week of the month, and the weather was fine and warm. The rain-fall in the month at southern stations was in excess, at Midland stations also in excess, but to smaller amounts; at extreme northern stations, and in Wales and in Ireland, the fall in the month was generally less than the average. The month upon the whole may be considered a fine one; and at the end of the month pastures and all root crops were reported in good condition.

Till the 13th July the average daily temperature was 2¼° in defect of the general average of those days; from the 14th to the 28th the temperature was a little warmer, the average daily excess being 1°·6; from July 29th to August 8th it was again cold, the average daily deficiency of temperature being 2°·3; from August 9th to September 12th, the weather was fine and warm, the average excess of daily temperature for these 35 consecutive days was 3°·9; on Saturday, September 4th, the warmest day, the excess of temperature over its average was 14°·4; a cold period of 9 days then set in, whose average daily deficiency of temperature was 2°·8; the last 9 days of the quarter were warm, the average daily excess of temperature being 4°·1.

In the neighbourhood of London *the readings of the barometer* were below their averages from the 1st to the 10th of July, with the exception of the 5th and 6th, on which days they were a little above; the mean amount of defect for the 10 days was 0·15 in. From the 11th to the 23rd, with the exception of the 15th, the readings were high, the mean amount of excess for this period was 0·07 in. From the 24th of July till the 8th of August the mean daily values were all below their averages, the mean amount of defect for these 16 days was 0·22 in. From August 9th to September 5th, with the exception of five days, viz., August 25th, 26th, 29th, 30th, and September 4th, the barometer readings were above their average values, and the mean amount in excess of the average for these 28 days was 0·10 in. A period of 16 days, viz., September 6th to the 21st, now followed with low pressure, especially on the 14th and 15th, the mean amount of defect for the 16 days ending the 21st was 0·28 in. From the 22nd till the end of the quarter the readings were all high, the mean excess being 0·32 in.

The mean reading for the month of July was 29·727 ins., being 0·073 in. below the average. The mean reading for August was 29·818 ins., being 0·035 in. above the average. The mean reading for September was 29·805 ins. being the same as the average.

The atmospheric pressure in July was less than in June by 0·006 in., that in August was greater than in July by 0·091 in., and that in September was less than in August by 0·013 in. (From the preceding 39 years' observations the *mean pressure* in July is less than in June by 0·008 in., that in August is 0·017 in. less than in July, and that in September is 0·022 in. greater than in August.)

The mean *decrease of pressure* from June to July from all stations was 0·036 in., the mean increase from July to August from all places was 0·130 in., and the mean decrease from August to September was 0·047 in.

At *Greenwich* the *mean temperature* of July was higher than that of June by 4°·2, that of August was higher than that of July by 1°·1, and that of September was lower than that of August by 3°·1. (From the preceding 39 years' observations the *mean temperature* of July is higher than that of June by 3°·1, that of August is lower than that of July by 0°·6, and that of September is lower than that of August by 4°·4.)

1880. Months.	Temperature of Air. Mean.	Air. Diff. from average of 109 years.	Air. Diff. from average of 39 years.	Evaporation. Mean.	Evaporation. Diff. from average of 39 years.	Dew Point. Mean.	Dew Point. Diff. from average of 39 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 39 years.	Water of the Thames.	Elastic Force of Vapour. Mean.	Elastic Force. Diff. from average of 39 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour. Diff. from average of 39 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
July	61·7	+0·1	−0·4	58·4	+0·7	55·5	+1·6	19·1	−1·9	..	0·441	+0·024	4·9	+0·2
August	62·8	+1·9	+1·3	60·0	+2·6	57·7	+3·8	17·1	−2·7	..	0·477	+0·059	5·2	+0·6
Sept.	59·7	+3·2	+2·6	57·1	+4·2	54·8	+3·8	17·5	−0·9	..	0·430	+0·052	4·8	+0·6
Means	61·4	+1·7	+1·2	58·5	+2·2	56·0	+3·1	17·9	−1·8	..	0·449	+0·045	5·0	+0·5

1880. Months.	Degree of Humidity. Mean.	Humidity. Diff. from average of 39 years.	Reading of Barometer. Mean.	Barometer. Diff. from average of 39 years.	Weight of a Cubic Foot of Air. Mean.	Weight. Diff. from average of 39 years.	Rain. Amount.	Rain. Diff. from average of 65 years.	Daily Horizontal movement of the Air.	Thermometer on Grass. Number of Nights it was At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
July	81	+6	29·727	−0·073	527	− 1	3·8	+1·3	238	0	0	31	41·8	58·8
August	83	+6	29·818	+0·035	527	− 1	1·0	−1·5	235	0	1	30	39·0	60·3
Sept.	84	+3	29·805	0·000	530	− 3	4·0	+1·6	220	0	4	26	37·2	58·0
Means	83	+5	29·781	−0·013	528	− 2	Sum 8·8	Sum +1·4	Mean 264	Sum 0	Sum 5	Sum 87	Lowest 37·2	Highest 60·3

NOTE.—In reading this table it will be borne in mind that the plus sign (+) signifies *above* the average, and that the minus sign (−) signifies *below* the average.

The average duration of the different directions of the wind referred to eight points of the compass, and the duration of each direction in each month in the quarter, were as follows:—

Direction of Wind.	July. Average.	July. 1880.	July. Departure from Average.	August. Average.	August. 1880.	August. Departure from Average.	September. Average.	September. 1880.	September. Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	2¼	2	− ¼	2	2	0	1¾	2	+ ¼
N.	3½	0	−3½	3	2	−1	3¾	2	−1¾
N.E.	3¾	1	−2¾	3	5	+2	5¼	1	−4¼
E.	1¼	1	− ¼	1½	6	+4½	1¾	1	− ¾
S.E.	½	3	+2½	1¼	5	+3¾	1¾	3	+1¼
S.	2¼	2	− ¼	3	3	0	2	4	+2
S.W.	10½	12	+1½	10¼	2	−8¼	7¼	7	− ¼
W.	4	10	+6	3¾	6	+2¼	2½	8	+5½
Calm (nearly.)	2½	0	−2½	3¼	0	−3¼	4½	2	−2½

The plus sign (+) denotes excesses over averages; the largest numbers affected with this sign in the month of July are opposite to the W., in August to the E. and S.E., and in September to the W.

The minus sign (−) denotes defects below averages; the largest numbers affected with this sign in the month of July are opposite to the N. and N.E., in August to the S.W., and in September to the N.E.

The increase of *mean temperature* from June to July was nearly the same everywhere, and the mean from all places was 3°·7, the mean increase from July to August from all stations was 2°·1, and the mean decrease from August to September from all places was 2°·8.

The mean temperature of the air for July was 61°·7, being 0°·1 above the average of the preceding 109 years, and 0°·4 below the average of the preceding 39 years. It was 3°·6 higher than that in 1879.

The mean temperature of the air for August was 62°·8, being 1°·9 and 1°·3, respectively, above the average of the preceding 109 years, and 39 years. It was 2°·9 above that in 1879.

The mean temperature of the air for September was 59°·7, being 3°·2 and 2°·6, respectively, above the averages of the preceding 109 years, and 39 years. It was 3°·4 above the value in 1879.

The mean temperature of the air for the quarter was 61°·4, being 1°·7 and 1°·2, respectively, above the averages of the preceding 109 years, and 39 years. It was 3°·3 above that in 1879.

The mean high day temperatures of the air were 1°·3, and 0°·1, respectively, below their averages in July and August, but 2°·1 above in September.

The mean low night temperatures of the air were 0°·7, 2°·6, and 3°·0, respectively, above their averages in July, August, and September. Therefore the days in July were somewhat cold; in August were about their average values; and in September were warm. The nights were warm throughout the quarter.

The mean daily ranges of temperature were 1°·9, 2°·7, and 0°·9, respectively, less than their averages in July, August, and September.

The fall of rain at Greenwich in July was 3·8 ins., being 1·3 in. above the average; the fall in August was 1·0 in., being 1·5 in. below the average. The following are the only instances back to 1815 of so small a fall of rain for the month of August as that in the present year, viz.:—In 1818 it was 0·1 in., in 1819 it was 0·4 in., in 1838 it was 0·9 in., in 1849 it was 0·5 in., in 1861 it was 0·6 in., and in 1871 it was 0·9 in. The fall in September was 4·0 ins., being 1·6 in. above the average. Back to 1815 there are but six instances of so large a fall of rain in September, viz.:—In 1818 it was 4·2 ins., in 1835 it was 4·2 ins., in 1839 it was 5·0 ins., in 1841 it was 4·0 ins., in 1842 it was 4·0 ins., and in 1871 it was 4·1 ins.

The total fall in the quarter was 8·8 ins., being 1·4 in. above the average of the preceding 65 years.

Thunderstorms occurred on the 1st of July at Lowestoft; on the 3rd at North Shields; on the 7th at Hull; on the 8th at Somerleyton, Lowestoft, and North Shields; on the 9th at Halifax and North Shields; on the 10th at Guernsey, Caterham, Strathfield, Cardington, and Stockton; on the 13th at Marlborough, Royston, Cardington, Stockton, Wolverhampton, Liverpool, Bermerside, and Hull; on the 14th at Salisbury, Strathfield, Oxford, Royston, Cardington, Stockton, Cambridge, Wolverhampton, Liverpool, and Hull; on the 15th at Osborne, Strathfield, Marlborough, Reading, Cardington, and Stockton; on the 16th at Strathfield and Cardington; on the 17th at Guernsey, Bath, Strathfield, Reading, Royston, Cardington, Stockton, Cambridge, Wolverhampton, Liverpool, Bolton, Llandudno, and Halifax; on the 18th at Guernsey, Strathfield, Cardington, and Llandudno; on the 19th at Cardington, Stockton, Kelstern, and Llandudno; on the 21st at Marlborough, Royston, Cardington; on the 22nd at Bath; on the 23rd at Hull; on the 25th at North Shields; on the 26th at Royston and Cardington; on the 29th at Salisbury, Royston, Cardington, Somerleyton, Cambridge, and Hull; on the 30th at Guernsey, Torquay, Salisbury, Bath, Marlborough, Bolton, Cardington, Somerleyton, and Stockton; on the 31st at Bath. On the 2nd of August at Salisbury, Marlborough, Cardington, Hull, and North Shields; on the 5th at North Shields; on the 6th at Bath, Royston, Cardington, Stockton, Cambridge, Hull, and North Shields; on the 7th at Somerleyton; on the 8th at Somerleyton, Hull, and North Shields; on the 26th at Osborne, Strathfield, Marlborough, Cambridge, and Kelstern; on the 28th at Salisbury and Marlborough; on the 29th at Royston, Cardington, and Leicester; on the 30th at Stockton, Halifax, and Leeds. On the 4th of September at Kelstern, Halifax, Silloth, and North Shields; on the 10th at North Shields; on the 11th at Royston, Somerleyton, and Kelstern; on the 12th at Lowestoft and Cambridge; on the 13th at Cardington; on the 14th at Royston, Cambridge, Wolverhampton, Kelstern, Bolton, and Hull, on the 18th at Cardington, Stockton, Cambridge, Kelstern, and Landudno; on the 19th at Somerleyton, Wolverhampton, Halifax, Hull, and North Shields.

Thunder was heard but lightning was not seen on 24 days in July, 9 days in August, and on 6 days in September.

Lightning was seen but thunder was not heard on 7 days in July, 8 days in August, and on 8 days in September.

Solar halos were seen on 6 days in July, 2 days in August, and on 2 days in September.

Lunar halos were seen on 23rd of July at Torquay, and at different places on 4 nights in September, viz., 13th, 16th, 17th, and 22nd.

Auroræ Boreales were seen, on the 12th of August at Brighton, Strathfield, Oxford, Leicester, Bolton, Silloth, Carlisle, and North Shields; and on the 13th at Torquay.

Hail fell on the 2nd of July at North Shields; on the 7th at Somerleyton; on the 8th and 9th at North Shields; on the 13th at Stockton; on the 15th at Reading and Oxford; on the 17th at Bath; and on the 20th at Somerleyton and Lowestoft. On the 2nd of August at Halifax; and on the 8th at Hull and North Shields. On the 13th of September at Torquay and Osborne; on the 14th at Hull; on the 18th at Cardington, Cambridge, Liverpool, Bolton, and Halifax; on the 19th at Wolverhampton, Bolton, Halifax, Hull, and North Shields.

MONTHLY METEOROLOGICAL TABLE FOR THE QUARTER ENDING SEPTEMBER 30TH, 1880.

The Observations have been reduced to Mean values by Glaisher's Barometrical and Diurnal Range Tables, and the Hygrometrical results have been deduced from the sixth edition of his Hygrometrical Tables.

NAMES of STATIONS and OBSERVERS.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean Of all Highest.	Temperature of Air in Month. Mean Of all Lowest.	Temperature of Air in Month. Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									
GUERNSEY. ADOLPHUS COLLENETTE, ESQ., F.M.S.	204	July	29·714	0·734	75·0	53·0	22·0	68·6	56·2	12·4	60·5	55·8	·446	5·0	0·9	85	528	114·1	54·3	1·2	5	3	11	12	2·1	3·6	14	2·41
		Aug.	29·752	0·675	76·0	54·0	22·0	68·3	58·8	9·5	62·0	58·1	·483	5·4	0·8	87	527	102·5	56·2	1·1	10	9	3	9	1·4	5·4	9	1·17
		Sept.	29·780	1·049	78·0	52·0	26·0	65·9	56·6	9·3	60·2	56·8	·463	5·2	0·7	90	529	97·8	53·6	1·3	7	6	8	9	1·8	5·3	19	5·41
TRURO (Cornwall), C. BARHAM, ESQ., M.D., F.M.S.	43	July	29·848	0·835	77·0	46·0	31·0	69·3	53·3	16·0	59·0	53·3	·407	4·6	1·0	82	532	—	—	2·3	6	1	8	16	—	6·0	16	3·44
		Aug.	29·923	0·866	82·0	44·0	38·0	73·8	56·4	17·4	62·4	55·7	·445	5·0	1·3	79	530	—	—	1·8	7	11	8	5	—	6·1	4	0·19
		Sept.	29·915	1·344	79·0	42·0	37·0	67·3	54·0	13·3	58·8	54·4	·425	4·7	0·9	85	533	—	—	2·2	5	3	10	12	—	7·3	16	2·65
PLYMOUTH (Devon), J. MERRIFIELD, ESQ., LL.D., F.R.A.S., F.M.S.	69	July	29·918	0·758	78·0	47·4	25·6	67·7	55·2	12·5	60·2	54·6	·426	4·8	1·1	82	532	—	—	1·3	4	5	10	12	—	7·1	19	3·01
		Aug.	29·971	0·699	76·0	51·0	25·0	70·1	57·9	12·2	63·0	57·1	·468	5·1	1·3	81	529	—	—	1·3	8	13	4	6	—	7·1	9	0·76
		Sept.	29·986	1·335	79·2	43·0	36·2	65·4	54·0	11·4	58·8	55·4	·439	4·8	0·7	88	534	—	—	1·2	7	9	7	7	—	7·5	17	3·55
TORQUAY. Babbacombe (Devon), EDWIN E. GLYDE, ESQ., F.M.S.	305	July	29·598	0·789	75·0	47·1	27·9	68·2	53·4	14·8	59·4	53·2	·406	4·5	1·2	80	527	139·3	46·5	1·3	2	4	8	17	4·8	6·1	22	2·56
		Aug.	29·678	0·951	76·6	50·8	25·8	68·6	56·6	12·0	61·2	55·6	·443	4·9	1·1	82	526	131·2	51·2	1·0	11	12	2	6	3·7	6·7	6	0·31
		Sept.	29·666	1·322	76·5	43·7	32·8	65·9	53·3	12·6	58·6	53·3	·407	4·6	0·9	83	529	126·3	46·7	1·2	5	5	7	13	4·7	6·8	15	3·52
VENTNOR, (Isle of Wight) (Royal National Hospital for Consumption), J. CODLING, ESQ.	150	July	29·836	0·676	74·8	48·2	26·6	66·6	54·3	12·3	59·0	55·4	·439	4·9	0·7	89	532	—	—	—	0	3	14	14	5·9	5·7	17	3·38
		Aug.	29·889	0·740	76·4	51·7	24·7	72·9	57·6	15·3	63·0	57·5	·474	5·2	1·2	82	528	—	—	—	11	10	3	7	4·5	5·6	8	0·70
		Sept.	29·898	1·100	77·2	47·5	29·7	67·0	55·9	11·1	60·4	55·9	·447	5·0	0·9	86	531	—	—	—	7	7	7	9	5·5	6·6	13	4·98
OSBORNE (Isle of Wight), J. R. MANN, ESQ.	172	July	29·728	0·758	81·0	47·5	33·5	71·1	53·9	17·2	60·6	57·2	·470	5·2	0·7	89	528	127·1	51·0	1·0	1	4	13	13	—	6·0	15	3·43
		Aug.	29·798	0·920	82·0	48·1	33·9	74·6	56·1	18·5	63·3	58·4	·490	5·4	1·0	84	526	123·9	52·9	0·9	11	9	4	7	—	6·5	8	1·01
		Sept.	29·796	1·148	81·4	46·7	34·7	68·7	53·9	14·8	60·0	56·4	·456	5·1	0·7	89	530	109·6	49·9	1·1	5	5	10	10	—	6·3	13	5·30
BRIGHTON (Sussex), F. E. SAWYER, ESQ., F.M.S.	206	July	29·710	0·657	78·7	48·3	30·4	71·0	55·1	15·9	61·7	54·0	·419	4·6	1·6	77	527	116·5	54·0	0·6	2	2	11	17	—	7·8	20	2·96
		Aug.	29·730	1·021	76·0	49·3	26·7	71·4	56·7	14·7	62·8	55·1	·434	4·9	1·5	76	526	118·0	54·7	1·1	17	6	3	5	—	5·9	7	0·75
		Sept.	29·793	1·101	75·2	43·0	32·2	66·9	53·4	13·5	59·7	53·1	·404	4·5	1·3	80	530	97·4	50·5	0·7	6	5	10	9	—	7·2	13	4·65
SALISBURY (Wilton House), Wilts, THOMAS CHALLIS, ESQ.	186	June	29·733	0·678	78·0	35·5	42·5	69·2	46·2	23·0	56·0	50·2	·365	4·1	0·9	81	533	111·9	45·4	1·2	10	4	5	11	—	7·5	20	2·21
		July	29·708	0·668	81·5	42·5	39·0	72·8	50·0	22·8	60·0	55·3	·438	4·9	0·9	85	528	119·1	48·8	1·4	2	2	9	17	—	7·1	20	4·63
		Aug.	29·800	0·892	83·0	43·0	40·0	75·0	52·1	22·9	61·9	56·2	·452	5·0	1·2	82	528	114·8	51·5	1·1	10	9	6	6	—	6·0	8	1·34
		Sept.	29·776	1·342	85·0	36·0	49·0	71·1	49·1	22·0	58·8	53·5	·410	4·5	1·0	82	531	103·7	47·5	1·2	6	5	8	11	—	6·5	16	2·89
BARNSTAPLE (Devon), WILLIAM KNILL, ESQ.	43	July	29·857	0·590	79·0	47·0	32·0	71·5	56·9	14·6	62·4	55·5	·442	4·9	1·3	79	529	—	—	1·0	1	4	10	16	—	2·3	20	7·14
		Aug.	29·941	0·090	80·5	42·0	38·5	75·5	55·1	20·4	64·2	56·0	·449	5·0	1·6	75	528	—	—	1·1	3	17	6	5	—	1·7	9	1·45
		Sept.	29·926	1·270	86·0	49·0	37·0	68·7	55·6	13·1	60·9	55·5	·440	4·9	1·1	83	531	—	—	1·3	2	2	16	10	—	3·8	16	4·07
CATERHAM (Surrey), "Metropolitan Asylum," G. STANLEY ELLIOT, ESQ., M.D.	608	July	29·228	0·720	76·8	47·0	29·8	67·8	52·3	15·5	59·2	52·4	·394	4·4	1·2	79	521	—	44·4	1·2	4	1	10	16	—	5·9	23	4·68
RAMSGATE (Kent), REV. E. DOUGLAS O'GARA, O.S.B., F.M.S.	108	Aug.	29·862	1·042	76·1	49·1	27·0	70·1	58·5	11·6	63·2	59·1	·503	5·6	0·9	87	527	—	—	1·1	10	11	4	6	—	6·6	—	—
		Sept.	29·892	1·231	79·2	44·2	35·0	68·0	54·6	13·4	60·3	56·0	·449	5·0	0·8	86	531	—	—	0·9	4	5	14	7	—	6·0	11	1·85

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Temperature of Air in Month. Lowest.	Temperature of Air in Month. Range.	Temperature of Air in Month. Mean Of all Highest.	Temperature of Air in Month. Mean Of all Lowest.	Temperature of Air in Month. Mean Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a Cubic foot of Air. Mean.	Vapour. In a Cubic foot of Air. Short of Saturation.	Mean Degree of Humidity, Satn. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	Wind. Relative Proportion of E.	Wind. Relative Proportion of S.	Wind. Relative Proportion of W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
STRATHFIELD TURGISS (Hants), Rev. C. H. Griffith, M.A., F.M.S.	197	July	29·693	0·648	78·5	45·3	33·2	70·6	52·4	18·2	60·4	54·6	·427	4·8	1·1	82	528	126·4	46·5	1·1	7	2	10	12	3·5	7·4	21	4·84
		Aug.	29·783	0·797	78·4	43·5	34·9	72·3	54·3	18·0	61·9	56·6	·457	5·0	1·2	83	527	122·3	50·1	0·9	10	11	5	5	3·3	6·2	9	0·99
		Sept.	29·782	1·187	83·7	41·9	41·8	68·7	51·0	17·7	59·1	54·9	·431	4·9	0·8	87	531	112·9	45·3	0·7	3	3	9	15	2·0	5·9	14	4·62
BATH (Somerset), St. Gregory's College, Downside, Rev. T. J. Almond, O.S.B., F.M.S.	596	July	29·252	0·699	75·4	47·3	28·1	65·9	52·4	13·5	57·4	52·8	·400	4·5	0·8	85	523	119·4	49·7	1·3	3	2	10	16	—	4·8	20	6·69
		Aug.	29·361	0·944	78·4	49·1	29·3	69·9	54·6	15·3	60·2	55·5	·441	5·0	0·9	85	522	117·0	52·7	1·1	11	10	5	5	—	6·5	7	0·81
		Sept.	29·337	1·293	83·2	45·0	38·2	65·1	51·5	13·6	57·0	53·8	·414	4·6	0·6	89	525	109·0	49·0	1·1	4	3	7	16	—	6·6	16	5·76
MARLBOROUGH (Wilts), Rev. Thomas A. Preston, M.A., F.M.S.	474	July	29·391	0·688	74·7	43·7	31·0	69·3	52·4	16·9	60·1	54·5	·426	4·7	1·1	82	523	125·0	46·5	0·6	2	4	11	14	—	7·7	21	4·37
		Aug.	29·499	1·014	77·7	46·0	31·7	70·8	54·2	16·6	61·3	56·1	·452	5·0	1·1	84	523	115·9	50·4	0·6	8	15	3	5	—	6·7	8	1·35
		Sept	29·474	1·280	84·5	40·1	44·4	67·4	50·9	16·5	58·4	53·5	·410	4·6	0·9	84	526	109·8	47·8	0·5	5	6	6	13	—	6·7	16	3·93
BLACKHEATH (London), James Glaisher, Esq., F.R.S.	160	July	29·724	0·696	78·5	45·0	33·5	72·1	52·1	20·0	60·4	54·1	·418	4·7	1·2	80	528	136·4	48·3	0·7	2	3	9	17	—	6·4	22	3·89
		Aug.	29·801	0·996	81·3	46·5	34·8	71·7	54·4	17·3	61·8	55·3	·437	4·8	1·3	80	528	113·4	51·2	0·7	6	11	6	8	—	6·9	7	0·97
		Sept.	29·799	1·270	87·5	41·5	46·0	68·9	50·6	18·3	59·0	52·9	·401	4·5	1·1	81	531	119·8	45·6	0·8	4	3	10	13	—	6·0	12	4·14
WHITCHURCH RECTORY (Oxon), (near Reading). Rev. J. Slatter, M.A., F.R.S., F.M.S	150	July	29·731	0·657	77·1	44·3	32·8	71·6	52·5	19·1	61·9	56·6	·457	5·0	1·2	83	527	—	—	1·3	3	2	12	14	—	6·9	25	5·44
		Aug.	29·846	1·094	79·7	45·0	34·7	71·5	54·2	17·3	61·8	55·3	·438	4·8	1·3	80	529	—	—	1·0	9	15	3	4	—	7·9	8	0·75
		Sept.	29·819	1·198	84·2	40·3	43·9	68·6	52·0	16·6	59·4	54·9	·431	4·8	0·9	86	531	—	—	1·0	5	4	9	12	—	6·0	13	4·04
CAMDEN SQUARE (London), G. J. Symons, Esq., F.R.S., F.M.S.	123	July	29·765	0·638	79·2	47·5	31·7	72·5	54·5	18·0	61·6	53·8	·414	4·6	1·5	76	528	118·8	51·7	—	8	4	7	12	—	6·6	23	5·10
		Aug.	29·857	1·156	82·6	47·8	34·8	74·5	55·9	18·6	63·3	56·3	·455	5·0	1·4	78	528	115·4	53·8	—	17	7	2	5	—	6·4	4	0·45
		Sept.	29·846	1·238	88·3	42·1	46·2	69·7	52·8	16·9	60·0	53·5	·409	4·6	1·2	79	531	107·1	48·5	—	15	5	4	6	—	5·6	12	4·04
OXFORD (The Observatory), E. J. Stone, Esq., M.A., F.R.S.	210	July	29·661	0·707	71·8	47·0	24·8	67·4	54·1	13·3	60·3	54·4	·422	4·7	0·8	81	527	118·6	51·7	1·9	2	4	13	12	1·4	7·6	24	6·22
		Aug.	29·786	0·978	75·5	48·9	26·6	68·9	55·7	13·2	61·5	56·3	·454	5·0	1·2	82	524	116·3	54·2	1·8	12	8	5	6	2·7	7·1	5	0·60
		Sept.	29·749	1·288	83·2	42·9	40·3	67·6	52·7	14·9	59·3	54·4	·423	4·7	0·9	84	530	112·5	50·4	1·6	4	5	10	11	1·2	6·6	13	3·59
GLOUCESTER COUNTY ASYLUM, E. Toller, Esq., M.D.	110	July	29·781	0·708	78·0	47·0	31·0	72·6	53·6	19·0	61·0	55·8	·445	5·0	1·0	83	528	125·3	51·3	1·2	7	2	1	21	2·1	5·6	20	5·15
		Aug.	29·907	1·074	81·0	47·5	33·5	72·1	54·6	17·5	62·1	56·3	·455	5·1	1·1	81	530	111·2	52·9	0·2	7	13	2	9	3·7	6·4	5	0·45
		Sept.	29·884	1·280	84·0	42·5	41·5	69·8	51·7	18·1	59·2	56·6	·458	5·1	0·5	91	532	109·9	49·1	1·1	7	2	3	18	1·3	5·6	10	3·25
ROYSTON (Hertfordshire), Hale Wortham, Esq., F.R.A.S., F.M.S.	269	July	29·626	0·680	78·0	45·5	32·5	71·4	51·4	20·0	59·3	55·2	·435	4·9	0·8	87	528	—	—	—	3	4	10	14	—	6·9	23	4·55
		Aug.	29·739	1·098	79·0	46·6	32·4	70·7	53·2	17·5	60·2	58·8	·463	5·2	0·7	89	529	—	—	—	18	5	2	6	—	7·5	7	1·14
		Sept.	29·714	1·240	86·1	41·6	44·5	69·5	50·5	19·0	58·5	53·2	·405	4·5	1·0	82	530	—	—	—	4	5	7	14	—	6·6	9	3·29
BEDFORD, Cardington, Mr. J. McLaren, Assistant to S. C. Whitbread, Esq., M.P.	105	July	29·737	0·700	76·6	46·0	30·6	71·2	53·0	18·2	61·1	56·8	·463	5·1	0·9	86	528	113·0	48·8	1·1	4	5	3	19	—	6·7	27	6·44
		Aug.	29·865	0·820	78·0	45·0	33·0	70·5	54·8	15·7	61·5	56·7	·462	5·1	1·0	85	530	103·3	51·5	1·0	10	14	1	6	—	7·0	7	1·00
		Sept.	29·826	1·250	85·0	40·0	45·0	68·2	50·7	17·5	59·0	55·8	·445	5·0	0·6	89	531	99·5	43·7	1·0	4	4	8	14	—	5·9	10	5·00
CAMBRIDGE (Trinity College), J. W. L. Glaisher, Esq., M.A., F.R.S.	40	July	29·814	0·690	78·4	46·0	32·4	72·4	52·6	19·8	60·2	55·5	·441	5·0	0·9	85	530	138·9	49·2	1·0	4	2	13	12	—	7·3	26	3·60
		Aug.	29·935	0·858	81·2	43·0	38·2	73·9	54·6	19·3	62·3	56·9	·465	5·2	1·1	83	530	129·9	51·3	1·0	10	13	3	5	—	6·6	9	1·45
		Sept.	29·901	1·280	87·6	43·0	44·6	71·1	50·7	20·4	59·8	54·7	·429	4·8	1·0	84	532	123·4	44·0	1·0	5	4	9	12	—	6·2	11	2·84
RUGBY (Warwickshire), Stockton, "The Rectory," W. Tuckwell, Esq.	289	July	29·552	0·632	78·0	41·0	37·0	70·8	50·6	20·2	58·5	53·7	·414	4·6	0·9	84	527	—	47·4	0·4	3	5	12	11	6·4	7·0	23	6·78
		Aug.	29·719	0·902	80·0	43·0	37·0	70·7	53·1	17·6	61·1	53·6	·411	4·6	1·4	77	528	—	52·0	0·2	13	9	4	5	5·0	5·8	4	1·39
		Sept.	29·644	1·218	86·0	39·0	47·0	68·9	49·4	19·5	58·4	54·8	·430	4·8	0·7	88	529	—	46·7	0·3	4	3	9	14	4·5	5·6	16	4·17
LOWESTOFT (Suffolk), S. H. Miller, Esq., F.R.A.S., F.M.S.	85	July	29·772	0·674	74·6	44·8	29·8	67·4	53·5	13·9	59·2	53·1	·405	4·6	1·1	81	530	117·4	51·1	0·7	4	8	6	18	—	6·8	21	4·78
		Aug.	29·886	1·050	72·3	47·8	24·5	67·3	56·7	10·6	62·0	56·8	·462	5·2	1·0	83	529	111·1	54·4	0·8	11	11	3	6	—	6·0	8	1·09
		Sept.	29·854	1·324	78·0	42·8	35·2	67·1	52·8	14·3	59·2	53·5	·410	4·6	1·0	82	532	110·2	48·6	0·4	5	4	6	15	—	5·0	13	2·45
SOMERLEYTON (Suffolk), The Rectory, Rev. C. J. Steward, F.M.S.	50	July	29·825	0·622	74·6	44·2	30·4	68·0	53·0	15·0	58·8	54·8	·431	4·7	0·8	86	532	—	—	1·0	4	4	12	11	6·8	6·4	23	4·23
		Aug.	29·932	0·802	74·2	48·0	26·2	67·5	56·0	11·5	60·6	56·7	·461	5·1	0·8	85	531	—	—	0·9	13	12	3	3	6·8	5·6	9	2·53
		Sept.	29·910	1·286	79·3	42·9	36·4	67·0	51·6	15·4	58·4	54·0	·419	4·6	0·8	85	534	—	—	0·9	5	5	10	10	6·1	5·6	13	2·69

Meteorological Table, Quarter ending September 30th, 1880.

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880.	Pressure of Atmosphere in Month.		Temperature of Air in Month.						Mean Temperature.		Vapour.					Mean Reading of Thermometer.		Wind.					Mean Amount of Ozone.	Mean Amount of Cloud.	Rain.	
								Mean						In a cubic foot of Air.							Relative Proportion of							
		Months.	Mean.	Range.	Highest.	Lowest.	Range.	Of all Highest.	Of all Lowest.	Daily Range.	Air.	Dew Point.	Elastic Force.	Mean.	Short of Saturation.	Mean Degree of Humidity, Sat. = 100.	Mean Weight of a cubic foot of Air.	Maximum in Rays of Sun.	Minimum on Grass.	Estimated Strength.	N.	E.	S.	W.			Number of Days it fell.	Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
WOLVERHAMPTON (Staffordshire), Wrottesley, E. Simpson, Esq.	500	July	29.292	0.680	74.2	43.4	30.8	67.1	51.0	16.1	57.2	52.8	.400	4.5	0.8	85	524	—	—	—	5	7	8	11	—	7.4	21	4.78
		Aug.	29.466	0.754	79.1	46.0	33.1	68.1	53.1	15.0	58.7	53.6	.411	4.6	1.0	83	525	—	—	—	10	13	4	4	—	7.8	5	0.47
		Sept.	29.394	1.178	82.7	40.1	42.6	65.6	49.5	16.1	56.6	51.8	.385	4.5	0.8	84	526	—	—	—	5	4	11	10	—	7.0	13	3.10
LEICESTER (Town Museum), W. J. Harrison, Esq., F.G.S.	238	July	29.505	0.668	73.0	47.0	26.0	67.0	53.1	13.9	59.1	52.5	.395	4.5	1.2	79	528	121.6	45.9	0.6	4	5	10	12	—	8.5	25	6.84
		Aug.	29.749	0.950	78.2	48.6	29.6	68.8	55.3	15.5	61.0	54.3	.424	4.7	1.3	79	528	111.0	47.0	0.6	12	10	4	5	—	7.5	11	2.34
		Sept.	29.700	1.275	84.4	43.0	41.4	66.1	51.8	14.3	58.8	52.5	.396	4.4	1.2	80	530	113.1	44.3	1.4	4	6	10	10	—	6.1	17	5.27
NOTTINGHAM (Notts), M. O. Tarbotton, Esq., C.E., F.G.S., F.M.S.	183	July	29.643	0.618	86.7	45.9	40.8	72.4	52.4	20.0	60.0	53.3	.438	4.9	0.9	85	527	112.3	52.7	0.2	3	7	9	12	0.9	7.0	26	5.52
		Aug.	29.807	0.741	75.5	45.6	29.9	68.0	54.5	13.5	59.9	53.9	.416	4.6	1.1	82	531	104.5	54.1	0.3	10	12	4	5	1.1	6.7	9	2.14
		Sept.	29.723	1.367	85.6	40.8	44.8	68.0	51.1	16.9	58.6	52.5	.396	4.4	1.1	80	530	103.1	49.6	0.3	5	6	11	8	0.8	5.2	16	3.98
LLANDUDNO (Carnarvonshire), James Nicol, Esq., M.D.	100	July	29.749	0.680	71.7	49.0	22.7	64.2	74.0	10.2	57.9	53.3	.409	4.6	0.8	85	531	—	—	0.5	6	3	4	18	—	6.9	19	6.67
		Aug.	29.916	0.869	71.0	50.5	20.5	66.6	76.3	10.6	60.6	54.3	.421	4.7	1.2	80	532	—	—	0.4	4	15	6	6	—	4.6	5	1.86
		Sept.	29.836	1.200	81.8	47.0	34.8	63.4	51.3	9.1	58.4	52.9	.402	4.5	1.0	82	532	—	—	1.2	6	2	4	18	—	6.1	16	2.16
KELSTERN GRANGE, near Louth (Lincolnshire), D. Grant Briggs, Esq., F.M.S.	393	July	29.442	0.655	71.7	42.6	29.1	65.1	50.6	14.5	56.7	52.5	.396	4.4	0.7	86	527	113.9	48.4	1.0	4	5	9	13	7.7	7.3	23	5.38
		Aug.	29.606	1.047	78.2	45.3	32.9	67.0	53.5	13.5	59.0	55.0	.433	4.9	0.7	87	528	115.4	51.6	0.8	12	11	3	5	7.2	7.1	9	1.88
		Sept.	29.530	1.306	81.3	41.7	39.6	66.0	50.4	15.6	57.4	51.6	.382	4.2	1.0	81	528	112.4	47.3	0.8	5	4	7	14	5.9	5.2	11	5.14
LIVERPOOL, The Observatory, John Hartnup, Esq., F.R.A.S.	197	July	29.631	0.654	72.7	49.8	22.9	64.4	54.6	9.8	58.0	52.3	.393	4.4	1.0	81	529	—	—	1.1	4	5	6	16	—	6.3	22	4.78
		Aug.	29.865	1.024	75.2	49.5	25.7	68.3	56.2	12.1	60.8	53.4	.408	4.6	1.4	78	525	—	—	0.8	5	14	5	7	—	6.0	6	1.51
		Sept.	29.727	1.202	82.4	47.3	35.1	64.4	53.9	10.5	58.0	52.7	.399	4.5	0.9	84	531	—	—	1.1	4	7	9	10	—	6.5	16	2.91
BOLTON, Sharples (Lancashire), Rev. T. Mackereth, F.R.A.S., F.M.S.	481	July	29.313	0.634	73.4	41.6	28.8	64.8	51.1	13.7	56.3	51.7	.384	4.3	0.8	85	525	82.9	45.9	0.5	5	3	10	13	4.5	8.0	24	5.82
		Aug.	29.190	0.948	81.5	44.0	37.5	69.5	51.5	18.0	59.4	52.5	.398	4.4	1.3	78	525	88.5	44.3	0.6	8	12	4	7	4.3	5.7	8	2.66
		Sept.	29.404	1.262	84.7	41.0	43.7	64.1	49.3	14.8	59.1	50.7	.370	4.2	0.9	82	527	76.7	42.8	0.8	5	2	12	11	4.5	7.1	18	6.77
HALIFAX, Bermerside Observatory (Yorkshire), E. J. Crossley, Esq., F.R.A.S.	530	July	29.351	0.628	73.7	43.0	30.7	66.0	51.1	14.9	56.4	51.9	.358	4.4	0.8	85	526	106.0	48.5	0.5	3	6	9	13	—	7.9	21	5.34
		Aug.	—	—	78.3	49.0	29.3	68.6	53.2	15.4	59.2	53.5	.410	4.6	1.0	82	528	103.6	49.7	0.3	7	14	4	6	—	6.5	7	1.76
		Sept.	29.427	1.200	85.5	40.0	45.5	65.6	50.8	14.8	56.8	52.0	.368	4.3	0.8	84	527	105.0	48.9	0.5	2	5	10	13	—	6.5	15	4.06
HULL (Yorkshire), The People's Park, Mr. E. Peake.	12	July	29.830	0.646	75.0	42.0	33.0	67.2	51.8	15.4	58.6	52.8	.394	4.4	1.1	80	532	91.5	49.3	0.7	4	6	7	14	0.4	8.0	22	4.57
		Aug.	30.018	1.002	77.0	45.0	32.0	69.3	54.6	14.7	61.3	54.4	.424	4.7	1.3	79	533	94.6	51.8	0.8	12	10	3	6	2.6	6.6	10	1.87
		Sept.	29.918	1.218	81.0	41.0	40.0	66.4	50.7	15.7	58.3	52.0	.389	4.3	1.1	79	531	87.6	48.1	0.9	5	5	10	10	2.3	7.2	16	5.05
STONYHURST (Lancashire), Rev. S. J. Perry, F.R.S., F.M.S., F.R.A.S.	363	July	29.458	0.645	75.0	46.5	28.5	66.3	51.0	15.3	56.8	52.6	.397	4.4	0.7	86	527	119.0	51.8	—	4	4	4	19	—	8.7	26	7.01
		Aug.	29.624	0.906	80.2	46.0	34.2	70.6	52.1	18.5	59.8	53.6	.412	4.6	0.8	81	527	122.9	53.9	—	8	13	1	9	—	6.8	6	2.24
		Sept.	29.550	1.209	82.0	42.0	40.0	64.8	49.5	15.3	56.3	50.9	.374	4.2	0.8	82	530	116.2	50.5	—	3	4	6	17	—	7.9	19	3.97
BRADFORD (Yorkshire), J. McLandsborough, Esq., C.E., F.G.S.	366	July	29.436	0.654	71.0	49.7	21.3	65.3	53.9	11.4	57.8	51.2	.377	4.2	1.1	79	526	85.5	—	1.0	3	7	7	14	—	7.3	25	5.89
		Aug.	29.643	0.822	79.3	49.5	29.8	69.3	55.5	13.8	60.7	52.5	.395	4.4	1.5	74	527	82.4	—	0.8	8	11	6	6	—	6.5	13	1.68
		Sept.	29.552	1.200	81.3	45.0	36.3	66.8	53.3	13.0	58.3	51.8	.386	4.3	1.1	79	528	78.6	—	0.8	6	6	7	11	—	5.8	16	3.75
LEEDS (Yorkshire), The Philosophical Hall, H. Crowther, Esq.	137	July	29.687	0.686	72.0	49.0	23.0	66.3	53.2	13.1	58.2	52.3	.394	4.4	1.0	81	530	79.1	—	2.1	4	7	3	17	—	4.3	20	4.46
		Aug.	29.883	0.942	80.0	48.0	32.0	71.5	55.0	16.5	62.0	55.3	.439	4.9	1.3	79	529	87.0	—	1.9	10	12	2	7	—	3.5	8	1.52
		Sept.	29.783	1.200	84.0	44.0	40.0	70.0	52.5	17.5	59.9	54.5	.424	4.7	1.1	83	530	90.4	—	1.9	4	4	5	17	—	4.0	11	8.04
COCKERMOUTH (Cumberland), H. Dodgson, Esq., M.D., F.M.S., F.R.A.S.	146	July	29.667	0.663	76.0	45.9	30.1	66.1	53.0	13.1	58.0	54.0	.418	4.7	1.3	86	530	119.9	49.0	0.3	6	6	8	11	1.5	7.5	21	4.46
		Aug.	29.864	0.904	82.1	44.6	37.5	71.7	52.7	19.0	61.0	52.4	.394	4.4	1.6	74	530	118.5	47.7	0.4	8	11	6	6	0.9	4.5	6	0.96
		Sept.	29.762	1.134	82.2	40.9	41.3	64.4	50.9	13.5	56.8	51.4	.380	4.2	0.9	82	531	104.8	43.9	0.4	6	4	10	10	1.1	7.1	19	5.17
SILLOTH (Cumberland), "The Rectory," Rev. F. Redford, M.A., F.R.A.S., F.M.S.	28	July	29.793	0.777	74.6	45.6	29.0	66.2	52.2	14.0	57.8	52.8	.393	4.4	0.9	89	532	113.8	47.0	1.1	1	10	5	15	7.7	7.3	23	4.61
		Aug.	29.993	0.942	78.0	43.6	34.4	69.6	52.3	17.3	59.9	53.7	.414	4.6	1.2	81	534	115.6	46.2	1.2	0	17	2	12	7.5	4.8	5	0.41
		Sept.	29.680	1.124	82.8	39.0	43.3	64.7	49.8	14.9	55.9	51.7	.385	4.3	0.7	87	536	109.5	42.3	1.2	2	5	4	19	6.5	5.5	18	4.21

Names of Stations and Observers.	Height of Station above Sea Level.	Year 1880. Months.	Pressure of Atmosphere in Month. Mean.	Pressure of Atmosphere in Month. Range.	Temperature of Air in Month. Highest.	Lowest.	Range.	Mean. Of all Highest.	Mean. Of all Lowest.	Mean. Daily Range.	Mean Temperature. Air.	Mean Temperature. Dew Point.	Vapour. Elastic Force.	Vapour. In a cubic foot of Air. Mean.	Vapour. In a cubic foot of Air. Short of Saturation.	Mean Degree of Humidity. Sat. = 100.	Mean Weight of a cubic foot of Air.	Mean Reading of Thermometer. Maximum in Rays of Sun.	Mean Reading of Thermometer. Minimum on Grass.	Wind. Estimated Strength.	Wind. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	Rain. Number of Days it fell.	Rain. Amount collected.
	feet.		in.	in.	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°									in.
CARLISLE, Spital (Cumberland), Isaac Cartmel, Esq., F.M.S.	114	July	29·701	0·714	75·5	41·7	33·8	68·2	51·2	17·0	57·7	53·5	·411	4·6	0·8	86	531	102·2	44·6	1·2	4	10	1	16	2·2	6·6	23	5·67
		Aug.	29·901	0·944	80·5	44·2	36·3	70·8	51·8	19·0	60·0	55·3	·438	4·9	0·9	85	532	105·2	44·8	1·1	5	14	2	10	1·3	5·4	6	1·22
		Sept.	29·786	1·134	83·7	37·2	46·5	66·1	47·1	19·0	55·7	51·8	·388	4·3	0·6	88	534	98·9	40·3	1·1	6	11	3	10	2·6	5·8	15	3·64
BYWELL (Northumberland), Mr. W. J. Tone, Assistant to W. B. Beaumont, Esq., M.P.	87	July	29·645	—	69·0	49·0	20·0	64·2	53·7	10·5	—	—	—	—	—	—	—	—	45·5	1·2	6	10	2	13	—	7·3	23	4·85
		Sept.	29·795	1·114	78·0	40·0	38·0	64·8	51·4	13·4	56·5	50·1	·363	4·1	1·0	79	534	72·8	42·1	1·0	5	4	2	19	—	6·5	11	4·55
NORTH SHIELDS (Northumberland), Robert Spence, Esq.	128	July	29·747	0·748	67·5	46·5	21·0	61·7	52·3	9·4	56·0	51·7	·386	4·3	0·7	86	534	—	51·9	1·2	8	7	4	12	—	7·1	25	4·67
		Aug.	29·963	0·727	72·0	48·2	23·8	63·7	54·1	9·6	57·7	53·9	·417	4·6	0·7	87	535	—	53·5	1·1	10	11	4	6	—	6·1	17	1·44
		Sept.	29·832	1·197	72·2	40·0	32·2	61·7	50·8	10·9	55·2	51·3	·379	4·2	0·7	87	536	—	50·4	1·3	8	3	6	13	—	4·5	17	4·34

Second Rain-gauges are placed—

			July.		August.		September.		Total in Quarter.
At Strathfield Turgiss, at the height of 38 feet *above the ground*, the amount collected was			3·47 inches.	-	0·77 inches.	-	3·22 inches.	-	7·46 inches.
,, Oxford,	,,	22 ,,	6·21 ,,	-	0·57 ,,	-	2·89 ,,	-	9·67 ,,
,, Cardington,	,,	36 ,,	5·74 ,,	-	0·74 ,,	-	4·20 ,,	-	10·68 ,,
,, Nottingham,	,,	89 ,,	5·21 ,,	-	2·11 ,,	-	3·85 ,,	-	11·17 ,,

Note.—*Barometer Reading*, Barnstaple, September 30th, at 3h. p.m., 29·37 inches, has been altered to 30·37 inches.

Fog prevailed on the 15th of July at Kelstern and Hull; on the 16th at Royston, Cardington, Stockton, Cambridge, and Kelstern; on the 17th at Torquay, Bath, Royston, Lowestoft, Stockton, Cambridge, and Kelstern; on the 22nd at Torquay; on the 23rd at Guernsey and Torquay; on the 27th at North Shields. On the 4th of August at Plymouth; on the 10th at Plymouth and Torquay; on the 11th at Plymouth, Torquay, and Landudno; on the 13th at Royston and Kelstern; on the 14th at Royston; on the 15th at Guernsey; on the 16th at Torquay, Bath, and Kelstern; on the 18th at Llandudno; on the 21st at Kelstern; on the 24th at Llandudno; on the 25th at Bath and Royston; on the 26th at Torquay, Bath, Royston, Cardington, Wolverhampton, and Kelstern; on the 27th at Torquay, Bath, Royston, Cardington, Somerleyton, Cambridge, and Kelstern; on the 28th at Guernsey, Bath, Cardington, and Kelstern; on the 29th at Guernsey; on the 30th at Guernsey and Bath; and on the 31st at Guernsey, Torquay, Bath, Royston, and Cardington. On the 1st of September at Guernsey, Torquay, and Cambridge; on the 2nd at Guernsey and Torquay; on the 3rd at Torquay and Cambridge; on the 4th at North Shields; on the 10th at Cambridge; on the 21st at Oxford; on the 22nd at Guernsey, Bolton, Llandudno; on the 23rd at Guernsey, Wolverhampton, Bolton, and Llandudno; on the 24th at Guernsey and Oxford; on the 25th at Guernsey; on the 26th at Guernsey, Torquay, Strathfield, and North Shields; on the 27th at Guernsey, Strathfield, Bolton, Wolverhampton, Hull, and North Shields; on the 28th at Truro, Torquay, Strathfield, Reading, Royston, Cardington, Stockton, Cambridge, Wolverhampton, Bolton, and Hull; on the 29th at Truro, Torquay, Strathfield, Marlborough, Reading, Oxford, Royston, Cardington, Stockton, Wolverhampton, Llandudno, Hull, and North Shields; on the 30th at Strathfield, Marlborough, Reading, Oxford, Royston, Cardington, Somerleyton, Lowestoft, Stockton, Cambridge, Wolverhampton, and Llandudno.

NAMES OF STATIONS.	Mean Pressure of dry Air reduced to the level of the Sea.	Highest Reading of the Thermometer.	Lowest Reading of the Thermometer.	Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	WIND. Mean Estimated Strength.	WIND. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	RAIN. Number of Days on which it fell.
	in.	°	°	°	°	°	°	°	°	°	in.	grs	gr.		grs.	°	°								
Guernsey - - -	29·501	78·0	52·0	26·0	67·6	57·2	23·3	10·4	60·9	56·9	·464	5·2	0·8	87	528	104·8	54·7	1·2	7	6	7	10	1·8	4·8	42
Truro - - -	29·516	82·0	42·0	40·0	70·1	54·6	33·3	15·5	60·1	54·5	·436	4·8	1·1	82	532	—	—	2·1	6	5	9	11	—	6·5	36
Plymouth - - -	29·589	79·2	43·0	36·2	67·7	55·7	28·9	12·0	60·7	55·7	·444	4·9	1·0	84	532	—	—	1·8	6	9	7	8	—	7·2	43
Torquay - - -	29·551	76·6	43·7	32·9	67·6	54·4	28·8	13·1	59·7	54·0	·419	4·7	1·1	82	527	132·3	43·1	1·2	6	7	6	12	4·4	6·5	43
Ventnor - - -	29·538	77·2	47·5	29·7	68·8	55·9	27·0	12·9	60·8	56·5	·453	5·0	0·9	85	530	—	—	—	6	7	8	10	5·3	6·6	38
Osborne - - -	29·484	82·0	46·7	35·3	71·5	54·6	34·0	16·9	61·3	57·3	·472	5·2	0·8	87	528	120·2	51·3	1·0	6	6	9	10	—	6·3	36
Brighton - - -	29·537	78·7	43·0	35·7	69·8	55·1	29·8	14·7	61·4	54·1	·419	4·7	1·5	78	528	105·6	53·1	0·8	8	4	8	10	—	7·0	40
Salisbury - - -	29·526	85·0	36·0	49·0	73·0	50·4	42·7	22·6	60·2	55·0	·433	4·8	1·0	83	529	112·5	49·3	1·2	6	5	8	11	—	6·5	44
Barnstaple - -	29·510	86·0	42·0	44·0	71·9	55·9	45·8	16·0	62·5	55·7	·444	4·9	1·3	79	529	—	—	1·1	2	8	11	10	—	2·6	44
Strathfield Turgiss -	29·524	83·7	41·9	41·8	70·5	52·6	36·6	17·9	60·5	55·4	·438	4·9	1·0	81	529	120·5	47·3	0·9	7	5	8	11½	2·9	6·5	44
Bath - - -	29·530	83·2	45·0	38·2	67·0	52·8	31·9	14·2	58·2	54·0	·418	4·7	0·8	86	523	115·1	50·5	1·2	6	5	7	12	—	6·1	45
Marlborough -	29·531	84·5	40·1	44·4	69·2	52·5	35·7	16·7	59·9	54·7	·423	4·8	1·0	83	524	116·9	48·2	0·6	5	8	7	11	—	7·6	45
Blackheath -	29·525	87·5	41·5	46·0	70·9	52·4	38·4	18·5	60·4	54·1	·419	4·7	1·2	80	529	123·2	48·4	0·7	4	6	8	13	—	6·4	41
Reading - -	29·522	84·2	[illegible]	43·9	70·6	52·9	37·1	17·7	61·0	55·6	·442	4·9	1·1	83	529	—	—	1·1	6	7	8	10	—	6·9	46
Camden Square -	29·527	88·3	42·1	46·2	72·2	54·4	37·6	17·8	61·6	54·5	·426	4·7	1·4	78	529	113·8	51·3	—	13	5	4	8	—	6·2	39
Oxford - - -	29·522	83·2	42·9	40·3	68·0	54·2	30·6	13·8	60·4	55·0	·433	4·8	1·0	82	528	115·8	52·1	1·8	6	6	9	10	1·8	7·1	45
Gloucester - -	29·510	84·0	42·5	41·5	71·5	53·3	35·3	18·2	60·6	56·2	·453	5·1	0·9	85	530	115·5	51·1	0·5	7	6	2	16	2·4	5·9	35
Royston - -	29·545	86·1	41·6	44·5	70·5	51·7	36·5	18·8	59·3	55·1	·434	4·9	0·8	86	529	—	—	—	8	5	6	11	—	7·6	39
Cardington - -	29·458	85·0	40·0	45·0	70·0	52·8	36·2	17·2	60·5	55·4	·457	5·1	0·8	87	530	105·3	48·0	1·0	6	8	4	13	—	6·5	44
Cambridge - -	29·482	87·6	43·0	44·6	72·5	52·6	38·4	19·9	60·8	55·7	·445	5·0	1·0	84	531	130·7	48·2	1·0	6	6	8	10	—	6·7	41
Rugby - - -	29·527	86·0	39·0	47·0	70·1	51·0	40·3	19·1	59·3	54·0	·418	4·7	1·0	83	528	—	48·7	0·3	7	6	8	10	5·5	6·1	43
Lowestoft - -	29·503	78·0	42·8	35·2	67·3	54·3	29·8	13·0	60·1	54·5	·426	4·8	1·0	82	530	112·9	51·4	0·6	7	6	5	13	—	5·5	42
Somerleyton -	29·506	79·3	42·9	36·4	67·5	53·5	31·0	14·0	59·3	55·2	·437	4·8	0·8	85	532	—	—	0·9	7	7	8	8	6·6	5·9	45
Wolverhampton	29·515	82·7	40·1	42·6	66·9	51·2	35·5	15·7	57·5	52·7	·399	4·5	0·9	84	525	—	—	—	7	8	8	8	—	7·4	41
Leicester - -	29·536	84·4	43·0	41·4	67·3	53·4	32·3	13·9	59·6	53·1	·405	4·5	1·2	79	529	116·2	45·7	0·9	7	7	8	9	—	7·4	53
Nottingham -	29·505	86·7	40·8	45·9	69·5	52·7	38·5	16·8	59·5	53·9	·417	4·6	1·0	82	529	106·6	52·1	0·3	6	8	8	8	0·9	6·5	51
Llandudno - -	29·529	81·8	47·0	34·8	64·7	54·8	26·0	9·9	59·0	53·5	·411	4·6	1·0	82	532	—	—	0·7	5	7	5	14	—	5·9	40
Kelstern Grange -	29·537	81·3	41·7	39·6	66·0	51·5	31·9	14·5	57·7	53·0	·404	4·5	0·8	85	528	113·9	49·1	0·9	7	7	6	11	6·9	6·5	[illegible]
Liverpool - -	29·530	82·4	47·3	35·1	65·7	51·9	27·9	10·8	58·9	52·8	·400	4·5	1·1	80	530	—	—	1·0	4	9	7	11	—	6·3	44
Bolton - - -	29·529	84·7	41·0	43·7	63·1	50·6	36·7	15·5	57·3	51·6	·383	4·3	1·0	82	520	82·7	44·3	0·6	6	6	9	10	4·4	6·9	50
Halifax - - -	—	85·5	40·0	45·5	63·7	51·7	35·2	15·0	57·5	52·5	·393	4·4	0·9	84	527	104·2	49·0	0·4	4	8	8	11	—	7·6	43
Hull - - -	29·532	81·0	41·0	40·0	67·6	52·4	35·0	15·2	59·4	53·0	·403	4·5	1·2	79	533	91·2	49·7	0·8	7	7	7	10	1·8	7·3	[illegible]
Stonyhurst - -	29·534	82·0	42·0	40·0	67·2	50·9	34·2	16·3	57·6	52·4	·394	4·4	0·8	83	528	119·4	52·1	—	5	7	4	15	—	7·7	51
Bradford - -	29·543	81·3	45·0	36·3	67·0	54·2	29·1	12·8	58·9	51·8	·386	4·3	1·2	77	527	81·5	—	0·9	6	8	7	10	—	6·5	54
Leeds - - -	29·515	84·0	44·0	40·0	69·3	53·6	31·7	15·7	60·0	54·0	·419	4·0	1·1	81	530	82·2	—	2·0	6	8	3	13	—	3·9	29
Cockermouth -	29·523	82·2	40·9	41·3	67·4	52·2	36·8	15·2	58·6	52·6	·397	4·4	1·3	81	531	114·4	46·9	0·3	7	7	8	9	1·2	6·4	46
Silloth - - -	29·522	82·3	39·0	43·3	63·8	51·4	35·6	15·4	57·9	52·6	·397	4·4	0·9	83	534	113·0	45·2	1·2	1	11	4	15	7·2	5·9	46
Carlisle - -	29·506	83·7	37·2	46·5	63·4	51·0	38·9	18·4	57·8	53·5	·412	4·6	0·8	86	532	102·1	43·2	1·1	5	12	2	12	2·0	5·7	44
North Shields -	—	72·2	40·0	32·2	62·4	52·4	25·7	10·0	56·3	52·3	·391	4·4	0·7	87	535	—	51·9	1·2	9	7	5	10	—	5·5	59

The highest temperatures of the air were at Camden Square, 88°·3; Cambridge, 87°·6; Blackheath, 87°·5; Nottingham, 86°·7; Royston, 86°·1; and Barnstaple and Rugby both 86°·0.

The lowest temperatures of the air were at Salisbury, 36°·0; Carlisle, 37°·2; Rugby and Silloth, both 39°·0; and Cardington, Halifax, and North Shields, all 40°·0.

The greatest daily ranges of the temperatures of the air were at Salisbury, 22°·6; Cambridge, 19°·9; Rugby, 19°·1; Royston 18°·8; Blackheath, 18°·5; and Carlisle, 18°·4.

The least daily ranges of the temperatures of the air were at Llandudno, 9°·9; North Shields, 10°·0; Guernsey, 10°·4; and Liverpool, 10°·8.

The greatest numbers of rainy days were at North Shields, 59; Bradford, 54; Leicester, 53; Stonyhurst and Nottingham, both 51; and Bolton, 50.

The least numbers of rainy days were at Gloucester 35, Truro and Osborne, both 36; Ventnor, 38; and Camden Square, Royston, and Leeds all 39.

The heaviest falls of rain were at Bolton, 14·75 inches; Leicester, 14·45 inches; Bath, 13·26 inches; Stonyhurst, 13·22 inches; and Barnstaple, 12·66 inches.

The least falls of rain were at Truro, 6·28 inches; Torquay, 6·39 inches; Plymouth, 7·38 inches; and Cambridge, 7·89 inches.

QUARTERLY METEOROLOGICAL TABLE for different PARALLELS of LATITUDE.

PARALLELS OF LATITUDE, &c.	Mean Pressure of dry Air reduced to the level of the Sea.	Mean of all Highest Readings of the Thermometer.	Mean of all Lowest Readings of the Thermometer.	Mean Range of Temperature in the Quarter.	Mean of all Highest.	Mean of all Lowest.	Mean Monthly Range of Temperature.	Mean Daily Range of Temperature.	Mean Temperature of the Air.	Mean Temperature of the Dew Point.	Mean Elastic Force of Vapour.	Mean Weight of Vapour in a cubic foot of Air.	Mean additional Weight required for saturation.	Mean degree of Humidity.	Mean Weight of a cubic foot of Air.	Mean Reading of Maximum in Rays of Sun.	Mean Reading of Minimum on Grass.	WIND. Mean Estimated Strength.	WIND. Relative Proportion of N.	E.	S.	W.	Mean Amount of Ozone.	Mean Amount of Cloud.	RAIN. Mean Number of Days it fell.
	in.	°	°	°	°	°	°	°	°	°	in.	grs.	gr.		grs.	°	°								
Guernsey - - - -	29·501	78·0	52·0	26·0	67·6	57·2	23·3	10·4	60·9	56·9	·464	5·2	0·8	87	528	104·8	54·7	1·2	7	6	7	10	1·8	4·8	42
Between the latitudes 50° and 51° -	29·538	79·4	44·6	34·8	69·1	55·0	30·8	14·1	60·5	55·6	·443	4·9	1·0	84	530	126·3	49·7	1·4	6	7	8	10	4·9	6·5	39
51° and 52° -	29·524	85·1	41·3	43·8	70·4	53·1	36·2	17·3	60·5	54·9	·431	4·8	1·1	82	528	116·9	49·6	1·1	6	6	8	11	2·4	6·1	43
52° and 53° -	29·509	84·0	41·5	42·5	69·1	52·6	35·4	16·5	59·6	54·5	·427	4·8	0·9	84	530	114·3	49·0	0·7	7	7	7	10	4·3	6·6	45
53° and 54° -	29·533	82·5	43·1	39·4	66·4	52·6	32·3	13·8	58·3	52·6	·397	4·4	1·0	82	529	98·8	48·8	0·8	6	7	7	11	4·0	6·8	47
54° and 55° -	29·517	82·7	39·0	43·7	67·5	51·2	36·9	16·3	58·1	52·9	·402	4·5	1·0	83	532	109·8	45·1	0·9	4	10	5	12	3·5	6·1	45
Mean for the Quarter, 50° to 55° Year 1877	29·552	79·4	35·7	43·7	66·2	50·3	34·9	15·9	57·1	50·9	·376	4·2	1·0	80	533	106·4	45·5	1·2	6	4	7	13	4·1	6·3	48
" 1878	29·505	85·4	37·5	47·9	69·0	52·6	35·6	16·4	59·9	53·3	·408	4·6	1·2	80	529	109·3	48·0	1·0	6	6	7	12	3·5	5·9	44
" 1879	29·463	77·2	37·1	40·1	64·7	50·8	31·6	13·9	56·5	51·4	·383	4·3	0·8	84	531	102·0	46·6	1·3	5	5	8	13	4·5	6·8	56
" 1880	29·524	82·7	41·9	40·8	68·5	52·9	34·3	15·6	59·5	54·1	·420	4·7	1·0	83	530	111·2	48·5	1·0	6	7	7	11	3·8	6·4	44

METEOROLOGY OF ENGLAND,

DURING THE QUARTER ENDING DECEMBER 31, 1880.

Remarks on the Weather during the Quarter ending December 31st, 1880.

By James Glaisher, Esq., F.R.S., *&c.*

The weather in October was cold and wet, this being in fact the coldest October since 1842, and the wettest on record at most places. Falls of rain exceeding one inch in 24 hours were unusually frequent. On the 20th snow fell all over the country, but the fall was much heavier in the south than in the north of England: the direction of the wind was N., and the temperature of the whole day was 15° below its average. Between the 4th and 26th, the direction of the wind was mostly from E., N., or N.E.; only a few days about the middle of the month were fine.

In November, the first and third weeks were cold, and the second and last were warm; the weather was variable; on the 13th, the temperature for the day was 12¼° in excess of its average, and on the 22nd it was as much below its average. Rain fell on every day from the 8th to the 26th.

In December the weather was mild; there was no rain during the first half of the month, but the rain was nearly continuous from the 16th to the end of the year.

The mean daily temperature of the air, with slight exception, was below its average till November 9th, the average daily deficiency for these 40 days being 4°·1; from November 10th to 17th there was an average daily excess of 6°; this was followed by a like period of seven days of average daily deficiency of 6°·9, and from November 24th to the end of the year, the temperatures were generally high, the average daily excess for these 37 days being 4°·0.

The fall of rain in October was exceptional, and was greatly in excess at many places; the greatest fall was at Guernsey 10·45 in., at Totnes 9·89 in., at Ramsgate 9·70 in.; it exceeded 8 in. at Torquay, Ventnor, and Eastbourne; at Blackheath the fall was 7·94 in. The heaviest fall previously registered in the last-named locality in any month was 7·00 in., in July 1828; the heaviest fall in any October was 6 in. in 1865 and in 1841; the average fall of rain for October is 2·8 in.

There were three periods in the month of exceptional fall of rain; viz., from the 4th to 10th 19th to 23rd, and 26th to 28th. The following table shows the fall of rain within these periods at the several stations.

Table showing the Falls of Rain at the several Stations on the 4th, 5th, 6th, 7th, 8th, 9th, 10th, 19th ,20th, 22nd, 23rd, 26th, 27th, and 28th of October 1880.

Names of Stations.	OCTOBER, 1880.													
	4th.	5th.	6th.	7th.	8th.	9th.	10th.	19th.	20th.	22nd.	23rd.	26th.	27th.	28th.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Guernsey	0·42	0·41	0·39	0·00	0·00	1·08	1·16	0·00	1·04	1·40	1·20	1·04	1·09	0·27
Truro	3·00	0·00	0·21	0·73	0·15	0·00	0·17	0·49	0·00	0·70	0·02	0·45	0·61	0·43
Plymouth	0·18	0·94	0·00	0·18	0·09	0·36	0·00	0·00	0·54	0·18	0·40	0·37	0·58	0·23
Totnes	1·88	0·01	0·53	0·15	0·46	0·18	0·27	0·89	0·00	1·35	0·00	1·05	0·62	0·14
Torquay	2·44	0·00	0·44	0·12	0·17	0·17	0·12	0·98	0·00	1·08	0·06	0·86	0·45	0·01
Eastbourne	0·75	0·08	0·10	0·16	0·63	1·77	0·01	0·16	0·75	0·21	0·25	1·42	0·39	0·50
Beachey Head	0·99	0·10	0·12	0·13	0·66	1·87	0·03	0·18	0·75	0·30	0·33	1·31	0·28	0·25
Ventnor	0·93	0·24	0·22	0·00	0·80	1·41	0·13	1·38	0·13	0·64	0·06	0·81	0·50	0·02
Osborne	0·64	0·43	0·26	0·04	0·08	0·15	0·00	0·22	0·03	0·09	0·05	1·67	0·42	0·04
Bournemouth	0·01	0·82	0·48	0·22	0·08	0·46	0·58	0·00	0·57	0·17	0·39	0·18	1·02	0·34
Brighton	0·48	0·08	0·13	0·61	0·50	1·17	0·00	0·63	0·15	0·22	0·00	1·00	0·22	0·08
Salisbury	0·90	0·04	0·43	0·04	0·14	0·34	0·15	0·57	0·13	0·29	0·02	0·77	0·98	0·12
Barnstaple	1·78	0·00	0·27	0·44	0·03	0·10	0·00	0·25	0·00	0·04	0·00	1·76	0·74	0·32
Bath	1·01	0·05	1·45	0·16	0·07	0·07	0·03	0·35	0·00	0·29	0·01	0·75	0·61	0·34
Ramsgate	0·43	0·34	0·12	0·09	1·33	0·01	1·95	0·00	0·95	0·11	0·00	0·00	1·30	0·90
Strathfield Turgiss	0·29	0·28	0·70	0·00	0·15	0·50	0·08	0·42	0·19	0·31	0·09	0·77	0·48	0·21
Marlborough	1·21	0·18	0·98	0·12	0·02	0·31	0·11	0·30	0·00	0·18	0·00	0·74	0·70	0·22
Bristol	0·01	1·81	0·11	0·93	0·08	0·00	0·04	0·00	0·07	0·00	0·11	0·23	1·43	0·48
Blackheath	0·24	0·47	0·56	0·36	0·28	1·20	1·28	0·03	0·84	0·27	0·32	0·64	0·54	0·51
Greenwich	0·24	0·46	0·54	0·34	0·35	1·14	1·22	0·09	0·72	0·33	0·21	0·64	0·48	0·51
Streatley	0·00	0·99	0·30	0·71	0·07	0·03	0·43	0·00	0·41	0·03	0·19	0·09	0·68	0·30
Camden Square	0·30	0·35	0·65	0·23	0·14	0·99	0·11	0·71	0·09	0·17	0·00	0·92	0·30	0·40
Oxford	0·00	1·04	0·21	1·09	0·09	0·00	0·11	0·04	0·38	0·00	0·08	0·13	1·01	0·50
Gloucester	0·00	1·50	0·05	1·00	0·05	0·05	0·01	0·05	0·01	0·00	0·02	0·15	1·10	0·42
Royston	0·61	0·31	1·36	0·08	0·00	0·15	0·00	0·12	0·11	0·04	0·00	0·94	0·42	0·31
Cardington	1·02	0·08	1·07	0·12	0·04	0·07	0·00	0·00	0·02	0·00	0·00	0·91	0·53	0·15
Somerleyton	0·51	0·07	0·86	0·09	0·26	0·04	0·02	0·05	0·40	0·02	0·03	0·62	0·14	0·14
Lowestoft	0·52	0·07	0·85	0·12	0·17	0·02	0·01	0·04	0·55	0·00	0·02	0·62	0·12	0·11
Cambridge	0·89	0·13	1·77	0·41	0·09	0·02	0·00	0·02	0·16	0·01	0·00	0·86	0·45	0·18
Stockton	1·62	0·48	0·92	0·21	0·16	0·01	0·00	0·00	0·01	0·00	0·00	0·85	0·52	0·37
Norwich	0·00	0·55	0·05	0·88	0·39	0·06	0·22	0·00	0·02	0·06	0·09	0·00	0·62	0·37
Leicester	1·44	0·34	0·74	0·10	0·46	0·01	0·00	0·00	0·07	0·02	0·01	0·78	1·20	0·13
Wolverhampton	1·19	0·10	0·42	0·04	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·93	1·63	0·45
Birmingham	0·00	1·60	0·43	0·60	0·10	0·12	—	—	—	—	—	0·04	1·13	1·50
Nottingham	0·00	1·21	0·29	0·30	0·34	0·08	0·02	0·02	0·00	0·11	0·00	0·00	0·89	1·40
Holkham	0·00	0·86	0·58	0·54	0·56	0·02	0·00	0·04	0·00	0·00	0·00	0·00	0·82	0·65
Llandudno	0·55	0·54	0·05	0·00	0·06	0·00	0·00	0·00	0·11	0·00	0·00	0·81	2·23	0·00
Sheffield	1·33	0·87	0·13	0·40	0·03	0·03	0·01	0·00	0·04	0·00	0·00	0·81	1·75	0·51
Kelstern Grange	1·44	0·61	0·19	0·40	0·15	0·02	0·01	0·00	0·19	0·03	0·00	0·77	1·64	0·56
Liverpool	0·03	0·78	0·44	0·01	0·08	0·00	0·00	0·11	0·00	0·00	0·00	0·31	0·73	1·47
Bolton	0·10	0·02	0·00	0·07	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·38	2·39	0·08
Bermerside (Halifax)	0·00	1·10	0·54	0·00	0·10	0·00	0·00	0·20	0·00	0·00	0·07	0·17	0·75	1·75
Hull	0·98	1·19	0·02	0·25	0·11	0·03	0·02	0·00	0·23	0·12	0·04	0·81	1·61	0·68
Stonyhurst	0·42	0·14	0·00	0·01	0·00	0·00	0·00	0·00	0·00	0·00	0·00	0·14	1·71	0·01
Bradford	0·76	0·54	0·01	0·09	0·02	0·02	0·00	0·01	0·00	0·08	0·01	0·67	1·71	0·39
Leeds	0·94	0·48	0·00	0·06	0·00	0·02	0·00	0·00	0·04	0·06	0·00	0·51	1·56	0·44
Cockermouth	0·00	0·35	0·22	0·00	0·03	0·00	0·00	0·13	0·00	0·00	0·00	0·34	0·01	0·76
Silloth	0·00	0·20	0·00	0·00	0·05	0·00	0·00	0·00	0·00	0·00	0·00	0·37	0·00	0·00
Sunderland	0·00	0·32	0·57	0·05	0·12	0·13	0·01	0·15	0·20	0·11	0·02	0·20	0·05	1·25
Carlisle	0·00	0·00	0·16	0·00	0·03	0·04	0·00	0·48	0·00	0·00	0·11	0·11	0·00	0·32
Bywell	0·52	1·05	0·15	0·18	0·25	0·15	0·00	0·00	0·00	0·05	0·00	0·02	1·20	0·70
North Shields	0·30	0·59	0·03	0·27	0·04	0·01	0·00	0·05	0·25	0·14	[illegible]	[illegible]	[illegible]	[illegible]

D

At every one of the stations south of Leeds an inch or nearly an inch of rain fell on one or more of these days, but north of Leeds, particularly in the Lake District, the falls were very small, and on several of the days no rain fell. It is remarkable that the fall of rain for the whole month in Cumberland and Westmorland was less than one sixth of the average.

In the neighbourhood of London *the readings of the barometer* were above their averages on the first three days of October; they were below from the 4th to the 9th, the mean amount of defect being 0·29 in., above from the 10th to the 19th, to the mean amount of 0·29 inch, below on the 20th, 21st, and 22nd, above on the three following days, and again below from the 26th to the 29th; the defect on the 28th was one inch nearly, and the mean amount of defect for these four days was 0·54 in. A period of 13 days of high pressure now followed, viz., from October 30th to November 11th, the mean amount of excess for these 13 days being 0·26 in. From the 12th to the 19th of November the barometer readings were considerably below their averages, that for the 16th being 1·06 in. in defect, the mean amount for the eight days ending the 19th being 0·53 in. From the 20th of November to the 12th of December the mean daily readings were all above their average values, with the exception of two days, viz., November 25th and 26th, when they were a little below; the mean amount of excess for the 23 days was 0·33 in. From December 13th to the 30th, the readings were all below their averages, and on November 24th and 29th to the extent of three quarters of an inch nearly; the mean amount of defect for the 18 days was 0·41 in. The mean reading for the last day of the year was 0·12 inch above the average.

1880. Months.	Temperature of Air. Mean.	Air. Diff. from average of 109 years.	Air. Diff. from average of 39 years.	Evaporation. Mean.	Evaporation. Diff. from average of 39 years.	Dew Point. Mean.	Dew Point. Diff. from average of 39 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 39 years.	Water of the Thames.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 39 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour. Diff. from average of 39 years.
	°	°	°	°	°	°	°	°	°	°	in.	in.	grs.	gr.
Oct. -	46·2	−3·4	−4·0	44·9	−3·2	43·4	−2·6	13·1	−1·6	..	0·281	−0·032	3·2	−0·4
Nov. -	42·5	+0·2	−0·9	40·5	−0·7	38·1	−1·2	12·0	+0·5	..	0·230	−0·015	2·7	−0·1
Dec. -	43·2	+4·2	+3·1	41·7	+3·3	39·8	+3·3	9·8	+0·4	..	0·245	+0·027	2·8	+0·2
Means -	44·0	+0·3	−0·6	42·4	−0·2	40·4	−0·2	11·6	−0·2	..	0·252	−0·007	2·9	−0·1

1880. Months.	Degree of Humidity. Mean.	Humidity. Diff. from average of 39 years.	Reading of Barometer. Mean.	Barometer. Diff. from average of 39 years.	Weight of a Cubic Foot of Air. Mean.	Weight. Diff. from average of 39 years.	Rain. Amount.	Rain. Diff. from average of 65 years.	Daily Horizontal movement of the Air.	Reading of Thermometer on Grass. Number of Nights it was At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
Oct. -	91	+4	29·705	−0·001	544	+ 5	7·7	+5·0	269	8	16	7	24·0	49·2
Nov. -	85	−3	29·793	+0·047	550	+ 2	2·1	−0·3	351	14	12	4	16·3	50·8
Dec. -	80	+1	29·748	−0·047	548	− 4	3·0	+1·0	352	10	16	5	22·7	46·6
Means -	88	+1	29·749	0·000	547	+ 1	Sum 12·8	Sum +5·7	Mean 324	Sum 32	Sum 44	Sum 16	Lowest 16·3	Highest 50·8

NOTE.—In reading this table it will be borne in mind that the plus sign (+) signifies *above* the average, and that the minus sign (−) signifies *below* the average.

The average duration of the different directions of the wind referred to eight points of the compass, and the duration of each direction in each month in the quarter, were as follow:—

Direction of Wind.	October. Average.	October. 1880.	October. Departure from Average.	November. Average.	November. 1880.	November. Departure from Average.	December. Average.	December. 1880.	December. Departure from Average.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
N.W.	2	4	+2	2¼	3	+¾	2	6	+4
N.	3	2	−1	3¾	2	−1¾	2¾	2	−¾
N.E.	2½	9	+6½	3½	5	+1½	2	1	−1
E.	1¼	3	+1¾	2	2	0	1¾	1	−¾
S.E.	1½	2	+½	2	0	−2	1¾	0	−1¾
S.	3½	1	−2½	3½	1	−2½	3	2	−1
S.W.	9	4	−5	7¾	11	+3¼	9¾	10	+¼
W.	4½	5	+½	2	6	+4	4	9	+5
Calm (nearly.)	3¾	1	−2¾	3¼	0	−3¼	4	0	−4

The plus sign (+) denotes excesses over averages; the largest numbers affected with this sign in the month of October are opposite to the N.E., in November to the S.W. and W., and in December to the W. and N.W.

The minus sign (−) denotes defects below averages; the largest numbers affected with this *sign in the month* of October are opposite to the S.W., in November to the S.E. and S., and *in December* to the S.E., but all directions from N. to S. round by E. were below their averages.

The mean reading for the month of October was 29·705 ins., being 0·001 in. below the average. The mean reading for November was 29·793 ins., being 0·047 in. above the average, and the mean reading for December was 29·748 ins., being 0·047 in. below the average.

The atmospheric pressure in October was less than in September by 0·100 in., that in November was greater than in October by 0·088 in., and that in December was less than in November by 0·45 in. (From the preceding 39 years' observations the *mean pressure* in October is 0·099 in. below that in September, that in November is 0·040 in. above that in October, and that in December is 0·049 in. above that in November).

There was a *decrease of atmospheric pressure* from September to October at all stations south of lat. 54°. South of lat. 51° the decrease was 0·122 in.; between lat. 51° and 52°, it was 0·106 in.; between lat. 52° and 53° it was 0·076 in.; between 53° and 54° it was 0·033 in., and north of 54° there was an increase of 0·028 in. From October to November there was an increase of pressure of 0·122 in. south of 51°; between 51° and 52° an increase of 0·088 in., and of 0·044 in. in the next degree; but north of 53° there was a decrease of 0·39 in. to 54°, and of 0·120 in. north of 54°. From November to December there was a small decrease everywhere.

At *Greenwich* the *mean temperature* of October was lower than that of September by 13°·5, that of November was lower than that of October by 3°·7, and that of December was higher than that of November by 0°·7. (From the preceding 39 years' observations the *mean temperature* of October is lower than that of September by 6°·9, that of November is lower than that of October by 6°·8, and that of December is lower than that of November by 3°·6.)

The decrease of *mean temperature* from September to October from all stations was 12°·7, the decrease from October to November was 3°·2, and from November to December there was a slight increase of mean temperature at stations south of lat. 52½°, and a slight decrease at stations north of this parallel.

The mean temperature of the air for October was 46°·2, being 3°·4 and 4°·0, respectively, above the averages of the preceding 109 years, and 39 years. Back to 1771 there are but seven instances of so low a mean temperature for October, viz.:—

In the year 1778, 46°·0.	In the year 1808, 46°·1.
„ 1782, 45°·2.	„ 1817, 45°·0.
„ 1784, 43°·9.	„ 1842, 45°·4.
„ 1786, 44°·7.	

The mean temperature of the air for November was 42°·5, being 0°·2 above the average of the preceding 109 years, and 0°·9 below the average of the preceding 39 years.

The mean temperature of the air for December was 43°·2, being 4°·2 and 3°·1, respectively, above the averages of the preceding 109 years, and 39 years.

The mean temperature of the air for the quarter was 44°·0, being 0°·3 above and 0°·6, below the averages of the preceding 109 years, and 39 years.

The mean high day temperature of the air was 5°·1, and 0°·2, respectively, below the average in October and November, but 3°·0 above in December.

The mean low night temperature of the air was 3°·4 and 0°·7 respectively, below the average in October and November, but 2°·8 above in December. Therefore the days and nights were cold in October and November, and warm in December.

The mean daily range of temperature was 0°·5, and 0°·4 greater than the average in November and December respectively, and 1°·6 less in October.

Thunderstorms occurred on the 7th of October at Torquay and Salisbury; on the 8th at Totnes and Torquay; and on the 9th at Totnes. On the 25th of November at Guernsey and Blackheath. On the 18th and 23rd of December at Guernsey.

Thunder was heard but lightning was not seen on the 8th of October at Torquay and Ventnor. On the 17th of November at Guernsey, and on the 25th at Carlisle.

Lightning was seen but thunder was not heard on the 7th of October at London and Ventnor; on the 8th at Salisbury; on the 29th at Torquay. On the 19th of November at Somerleyton; on the 25th at Cardington; and on the 26th at Liverpool, Bolton, Halifax, and Carlisle. On December 23rd at Totnes and 25th at Somerleyton.

Solar halos were seen on the 18th of October at Hull; on the 19th at Kelstern and North Shields; on the 21st at Oxford and Cardington; on the 22nd at Cardington; on the 23rd at Oxford. On the 1st, 5th, 9th, and 12th of November at Torquay; on the 19th at Oxford; on the 26th at Stonyhurst; and on the 29th at Oxford. On December 18th at Torquay and Halifax; on the 23rd and 24th at Torquay, and 30th and 31st at Halifax.

Lunar halos were seen on the 12th of October at Leicester; on the 14th at Oxford; on the 15th at Leicester; on the 19th at North Shields; on the 21st at Oxford, Cardington, and Cambridge; on the 22nd at Kelstern and Liverpool, and on the 23rd at Hull. On the 8th of November at Leicester and Stonyhurst; on the 11th at Stockton; on the 12th at Oxford and Halifax; on the 15th at Torquay and Stonyhurst; on the 16th at Hull; and on the 18th at Halifax; and in December on the 11th, 12th, 13th, 14th, 15th, and 19th at different places.

Auroræ Boreales were seen on the 3rd of November at Lowestoft, Cambridge, and Liverpool, and on the 27th at Bradford.

Snow fell on the 2nd of October at Liverpool; on the 17th at Carlisle; on the 19th at Strathfield, and Kelstern; on the 20th all over the country; on the 21st at Royston, Stockton, Cambridge, Bywell, and North Shields; on the 22nd at North Shields; on the 26th at Stockton and Bolton, on the 27th at Bolton, Stonyhurst, Leeds, and North Shields; on the 28th at North Shields; and on the 29th at Stockton, Kelstern, Liverpool, and North Shields. On the 3rd of November at Cambridge; on the 15th at Leicester, Bolton, Llandudno, and Halifax; on the 16th at Halifax, and North Shields; on the 17th at Whitchurch, Wolverhampton, Hull, Leeds, Carlisle, and North